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VOLUME V

- Energy Fuels Corporation -

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Mine and
Reclamation Plan

ENVIRONMENTAL IMPACT STATEMENT

NORTHWEST COLORADO COAL

U.S. DEPARTMENT OF THE INTERIOR
March 3, 1849

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PREFACE

This is Volume V of the Northwest Colorado Coal Environmental Impact Statement. Contained herein is the environmental analysis of Energy Fuel's proposed coal mine development. Although this analysis is intended to stand alone, some reference is made to the Regional Analysis found in Volume I. All impacts of Energy Fuel's proposal are assessed over and above the future environment without the proposed action as presented in Chapter IV of the Regional Analysis.

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ENERGY FUELS CORPORATION

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Chapter I

Description of the Proposed Action

THIS CHAPTER IS A DETAILED DESCRIPTION OF ENERGY FUELS CORPORATION'S PROPOSAL TO MINE AND RECLAIM FEDERAL COAL LANDS IN ROUTT COUNTY, COLORADO. THE CHAPTER IS DEVELOPED BY DESCRIBING THE STAGES OF IMPLEMENTATION OF THE CORPORATION'S PROPOSAL. THESE ACTIONS ARE USED IN CHAPTER III TO IDENTIFY AND ANALYZE IMPACTS. THE FEDERAL ACTIONS THAT WOULD BE REQUIRED ARE DESCRIBED ON AN AGENCY-BY-AGENCY BASIS AND OTHER DEVELOPMENTS IN THE AREA OF THE PROPOSED ACTION ARE DESCRIBED TO THE EXTENT THAT THEY MAY CONFLICT WITH OR COMPLEMENT THE PROPOSAL.

CHAPTER I

DESCRIPTION OF THE PROPOSED ACTION

The Applicant's Proposal

On November 13, 1974, Energy Fuels Corporation submitted a mining and reclamation plan to the office of the Area Mining Supervisor of the United States Geological Survey (USGS) in Denver, Colorado, for expansion of their coal mining operations in Routt County, Colorado. A revision of this plan was filed on February 5, 1975 and a second revision was filed on April 30, 1975.

The latest revision described the company's five year operational plan on its three currently held Federal coal leases and private land, and on six competitive lease application tracts which the company has requested the government put up for public auction. The plan includes the company's long range (15-year) mine strategy and future coal lease requirements as well.

The 5-year mining plan for the company's three currently held Federal coal leases was approved on June 20, 1975, on an interim basis. Pending findings and determinations of this Environmental Impact Statement, additional stipulations may be imposed on the mining plan. Because environmental data have been accumulated on the six competitive lease application tracts, and because the company proposes to mine these tracts within the 15-year time-frame of this statement, they will be analyzed in conjunction with the mine plans for the company's three currently held Federal coal leases. However, it should be emphasized that the company does not own these six tracts nor does it have any expressed right to acquire the tracts.

The action before the Federal government is review of the mine plans on Energy Fuels' three Federal coal leases with identification of any additional stipulations which may be required and action on the six competitive lease application tracts which Energy has requested the government put up for auction. The USGS in reviewing Energy Fuels' overall plans has determined them to be a major Federal action significantly affecting the environment. Pursuant to Section 102(2)(c) of the National Environmental Policy Act of 1969, an Environmental Impact Statement is therefore required.

Background and History

Energy Coal Company began operations at the project site in 1962 on Federal coal lease D-052547. The company began mining coal in the W 1/2 of Section 32, T.5N., R.86W., and progressed southeastward into Sections 8 and 9, T.4N., R.86W., on land held under coal leases D-052547 and C-081330. All operations involved surface mining methods.

Energy Coal Company was purchased by Energy Fuels Corporation on March 15, 1972. Energy Fuels has since expanded operations with the opening of two additional strip pits.

The Energy 2 mine operation was begun in 1972 near Fish Creek in Section 25, T.5N., R.87W., on fee lands. Mining has progressed north and east toward federally owned coal. In 1970, following the issuance of a coal prospecting permit, an application for a preference right lease was filed for land east of Energy 2 fee land. This lease (C- 0128433), containing 474.93 acres in Sections 19 and 30, T.5N., R.86W., was granted in

June 1975. Mining began in the southwest quarter of Section 30 shortly thereafter. Energy 2 mine is shown in Figure EII-3.

In 1974, Energy Fuels began removing overburden, and in 1975 began loading and stockpiling coal at Energy 3 mine. This new mine is located on private coal land in Sections 1 and 2, T.5N., R.86W., about seven miles northeast of Energy 1 mine. In July 1975, following completion of new railroad load-out facilities, actual coal production began. The mine is shown in Figure EII-4.

Mining is currently taking place at the Energy 1 mine, the original mine begun by Energy Coal Company, on Federal lease D-052547 in Section 33, T.5N., R.86W., and private coal lands in Section 32. The mine is shown in Figure EII-2.

Coal production in Energy Coal Company's first year of production, 1962, totaled 23,000 tons. Coal production has steadily increased over the years of Energy Coals and Energy Fuels operations and reached 1,815,543 tons in 1974. Yearly production is shown in the tabulation on the following page.

Yearly Production From
Energy Fuels Corporation's Mines

Year	Energy 1 (tons)	Energy 2 (tons)
1962	23,122	
1963	309,618	
1964	358,215	
1965	393,068	
1966	416,096	
1967	495,107	
1968	505,045	
1969	564,933	
1970	621,889	
1971	517,903	
1972	747,406	21,871
1973	702,573	186,136
1974	1,240,150	575,393
Total	6,895,125	783,400
	Total	7,678,525 tons

The bulk of Energy Fuels' coal production is consumed by coal-fired generating plants, and the majority of its customers are utility companies. Approximately 80 percent of the mines' current output is delivered to Public Service Company of Colorado. In addition to coal already contracted, Energy Fuels has received numerous invitations to bid on coal requirements of other utility and industrial customers.

Energy Fuels Corporation operates on a fiscal year which begins on April 1 and ends on the following March 31. Energy Fuels has sales contracts for the current fiscal year (ending March 31, 1976) for 3,325,000 tons of coal to be produced from Energy mines 1, 2, and 3. With the acquisition of additional coal sale contracts in the future and the addition of new equipment, Energy Fuels projects that total tonnage from the mines will reach five million tons/year by 1977. The company expects to maintain that tonnage rate for at least the next 15 years, so from 1977 to 1992, 75 million tons would be mined. Assuming that the majority of this coal is mined from the Wadge seam, the major coal seam in the area, it is estimated that 5,170 acres (8.1 square miles) or approximately 345 acres/year would be stripped and reclaimed by the company.

In anticipation of the expansion of operations to five million tons/year, the company has recently spent several million dollars on improvement work. Two new coal handling and loading facilities, one for the Energy 1 and 2 mine complex, and another for Energy 3 mine have recently been completed. A new maintenance facility, equipped with five bays for accommodation of heavy equipment, was constructed by the company. Four miles of County Road 27 was recently moved at a cost of over one million dollars to give access to strip coal underlying the old roadbed in the Energy 1 vicinity. Finally the company has begun to receive delivery of a new 55-yard dragline, which after construction will greatly increase stripping capacity.

Energy Fuels Corporation is presently the designated operator of three Federal coal leases. In addition, the company has made application to the Bureau of Land Management (BLM) for six competitive leases. Energy Fuels also owns or leases approximately 5,300 acres of private coal land. Copies of the three Federal leases on which Energy Fuels is mining, including their legal descriptions, are included in Appendix D.

Coal lease D-052547, containing 853.27 acres, was issued effective March 1, 1945 to Thomas P. Greenhalgh. The lease was modified on March 9, 1948, with the addition of 291.86 acres, so it currently contains 1,145.13 acres. The lease is located about nine miles northwest of Oak

Creek, Colorado, and embraces parts of Sections 28, 29, 32, and 33, T.5N., R.86W. and part of Section 9, T.4N., R.86W. The lease was assigned from Greenhalgh to Morgan Coal Company effective March 1, 1962. Morgan Coal Company appointed Energy Coal Company the designated operator on April 20, 1962, and Energy Fuels Corporation the designated operator on October 10, 1972.

The lease with the BLM is a continuing lease subject to reasonable readjustment of terms on a 20-year basis. The original lease provided for a royalty of 15 cents/ton of coal mined. The annual rental was set at $0.25/acre for the first year; $0.50 for the second, third, fourth, and fifth years; and $1.00/acre for the sixth and each succeeding year during the continuance of the lease. Rental for any year is credited against the first royalties as they accrue under the lease during the year for which the rental is paid. The modified lease of 1948 retained the same royalty rate of 15 cents/ton of coal mined. Rental on the additional land was set at $0.25/acre for the period from the date of the modification to the next anniversary of the lease. Thereafter the rental rate was to be the same as the lands embraced in the original lease.

The first 20-year anniversary of the lease occurred in 1965; on February 4, 1965, the lease terms were readjusted. The readjusted royalty rate was set at 15 cents/ton from March 1, 1965, to February 28, 1973, (8 years); 16 1/2 cents/ton from March 1, 1973, to February 29, 1980, (7 years); and 18 1/2 cents/ton from March 1, 1980, to February 28, 1985, (5 years).

Coal lease C-018330 containing 2,175.28 acres was issued on November 1, 1963, to Morgan Coal Company. The lease is located about nine miles northwest of Oak Creek, Colorado, in parts of Sections 20, 21, 29, and 33, T.5N., R.86W., and parts of Sections 8, 9, 17, and 18, T.4N., R.86W. On April 1, 1970, the lease was modified with the addition of 40 acres in Section 28, T.5N., R.86W., so the lease now totals 2,215.28 acres. Royalty on the original lease was set at 15 cents/ton for coal mined by underground methods and 17 1/2 cents/ton for coal mined by stripping or surface auger methods. Royalty on the 40-acre tract acquired through modification was set at 15 cents/ton for coal mined by underground methods and 17 1/2 cents/ton for stripped-mined coal during the first ten years, and 17 1/2 cents for underground coal and 20 cents for strip-mined coal during the second 10 years. Rental rates and provisions are identical to those in coal lease D-052547 described previously. Morgan Coal Company appointed Energy Coal Company the designated operator on February 18, 1964. Energy Fuels was appointed designated operator on October 10, 1972.

Coal lease C-0128433 containing 474.93 acres was issued on June 1, 1975, to Morgan Coal Company. The lease is located about eleven miles northwest of Oak Creek, Colorado, in parts of Sections 19 and 30, T.5N., R.86W. Morgan Coal Company was originally issued a prospecting permit for the lands included in this lease in 1968. Prior to the expiration of the prospecting permit of 1970, Morgan Coal Company made application for a preference right lease. Before the lease was issued, a moratorium on further Federal coal leasing was called by then-Secretary of the Interior, Rogers C. B. Morton. This moratorium became effective in May 1971. In

February 1973 the Secretary announced a program whereby leases could be granted provided they met the short-term leasing criteria. Preference right lease C-0128433 was issued under this criteria. Energy Fuels Corporation was appointed the designated operator on October 10, 1972.

The lease provides for advance payment of an annual rental of $3.00 for each acre or fraction thereof covered by the lease. Payment is due on the effective date and on each anniversary date thereafter. For each year the rental is credited against any production and advance royalties for that year as they accrue under the lease.

Production royalty is eight percent of the gross value of the coal produced but not less than 40 cents/ton. An advance royalty is due monthly at the rate of eight percent of gross value based on the following annual production rates: 10,100 tons/lease month for the sixth lease year, 15,200 tons/lease month for the seventh lease year, 20,200 tons/lease month for the eighth lease year, 25,300 tons/lease month for the ninth lease year, and 30,300 tons/lease month for the tenth and each succeeding lease year.

The lease also contains a minimum production clause and several environmental stipulations covering rehabilitation, water pollution, air pollution, etc.

Until June 1975, Energy 1 mine was the only one of the three Energy Fuels mines which was operating on Federal lease lands. This mine has been operating under an approved plan of October 16, 1962. On November 13, 1974, Energy Fuels Corporation submitted a mining and reclamation plan to the office of the Area Mining Supervisor of the USGS in Denver, Colorado, for his approval. A revised mining plan was filed on February 5, 1975, and a second revision was filed on April 30, 1975. The mining and reclamation plan of April 30 covers the continuation of operations of Energy Strip 1 for five years on Federal coal leases D-052547 and C-081330, and progression into competitive lease application C-16284. This plan shows the mine generally progressing southwest in the next five years. In addition the plan covers Federal land in the Energy 2 mine vicinity. Five year mining and reclamation plans for both recently acquired Federal coal lease C-0128433 and competitive lease application C-20900 are described below. The company's mining plans for its privately owned coal in the vicinity of Energy 1 and 2 mines are also summarized.

As shown by the mining and reclamation plan for the five year interval from 1975 through 1979, 22 million tons of coal will be mined from approximately 1,840 acres. Detailed mine planning beyond this period is not practical at this time as the company will have depleted its economically strippable coal reserves from within current Federal coal leases and adjacent private coal lands. It would therefore be necessary for Energy Fuels to acquire additional Federal coal lands within the area for the company to remain operational. In anticipation of this, the company has made application to the Federal government for four additional competitive leases on coal acreage that lies adjacent to presently held lands. The April 31, 1975, mine plan describes these tracts and the company's general mine plans for them; because no extensive drilling has been undertaken on these tracts, detailed mine planning was not possible. Successful acquisition of these tracts by Energy Fuels at public auction would necessitate the submittal of formal exploration drilling plans and later mining and reclamation plans to the Area Mining Supervisor of the USGS. Acquisition of these lease application areas in a timely fashion would ensure that the company remains operational past 1980. Also, it is felt that a significant amount of coal in the area could be extracted by underground methods. Energy Fuels is currently developing preliminary plans for an underground operation.

Site location

Energy Fuels Corporation is presently operating three surface mines located in T.5N., R.85W., T.4, 5 and 6N., R.86W., and T.5N., R.87W. This area lies 8-12 miles northwest of Oak Creek, Routt County, Colorado and 10-18 miles southwest of Steamboat Springs, the county seat. A railroad spur of the Denver and Rio Grande Western Railroad serves the mines from the town of Milner, west of Steamboat Springs. The three mine sites are shown in Figure EI-1.

Stages of Implementation

Proposed mining procedures

The following description of mining and reclamation activities is taken from the mining and reclamation plan submitted by Energy Fuels Corporation.

The present mining operations will continue at all three of Energy Fuel's pits. Production is expected to climb to 5,000,000 tons per year by 1977. It is anticipated that production would continue at this rate for at least the next 15 years. At this rate of production, by 1980 most of the company's present strippable reserves contained in private and Federal lease lands would be depleted. Additional Federal leases would have to be acquired for Energy Fuels to remain operational in the vicinity of their present operations.

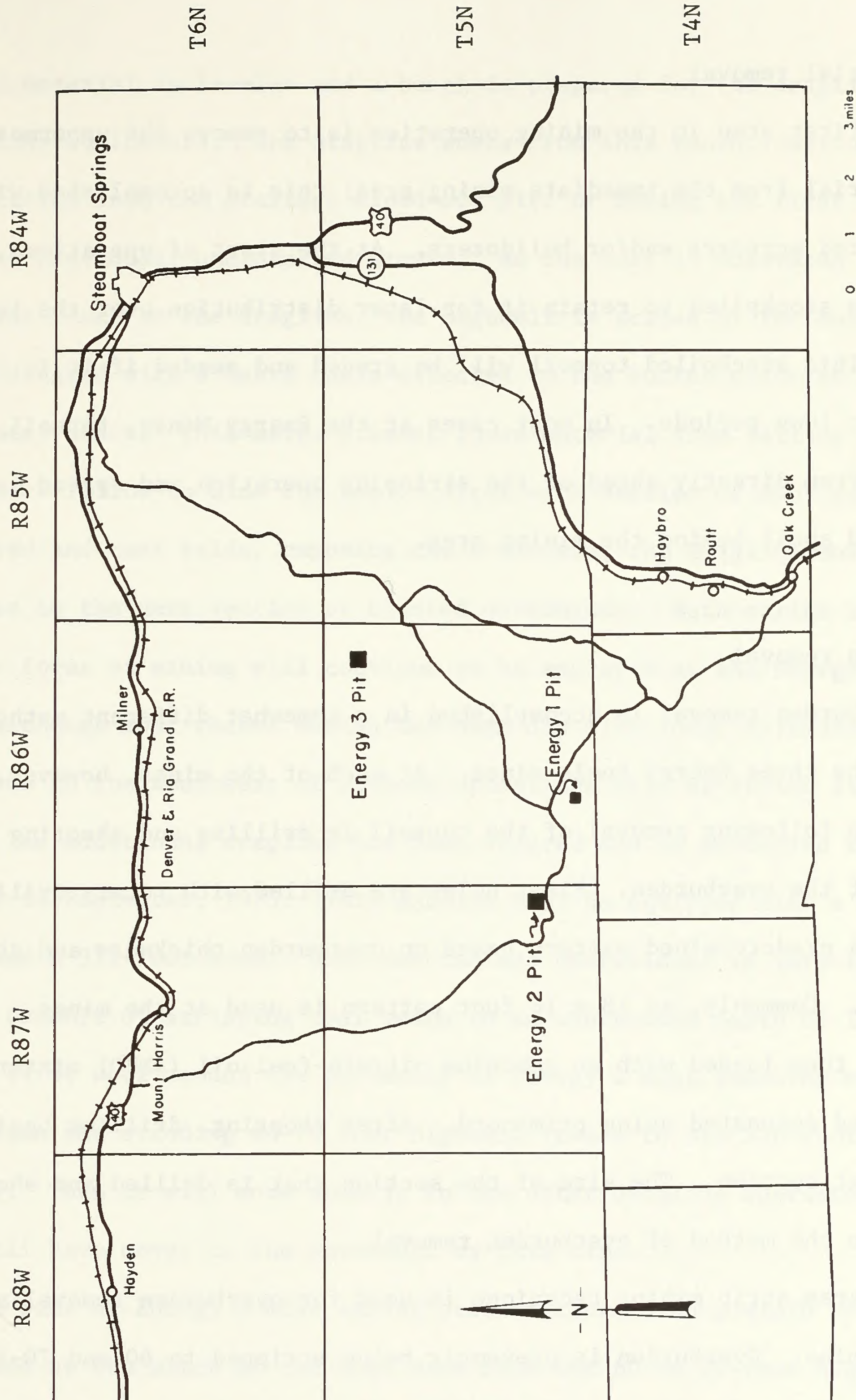


FIGURE EI-1

Location map of Energy Fuels Corporation mines.

Soil material removal

The first step in the mining operation is to remove the uppermost soil material from the immediate mining area; this is accomplished with rubber-tired scrapers and/or bulldozers. At the start of operations, the topsoil is stockpiled to retain it for later distribution over the leveled spoils. This stockpiled topsoil will be graded and seeded if it is to be stored for long periods. In most cases at the Energy Mines, topsoil will be taken from directly ahead of the stripping operation and spread over the graded spoil behind the mining area.

Overburden removal

Overburden removal is accomplished in a somewhat different method at each of the three Energy Fuels mines. At each of the mines, however, the first step following removal of the topsoil is drilling and shooting of a section of the overburden. Blast holes are drilled with rotary drill units on a predetermined pattern based on overburden thickness and characteristics. Commonly, an 18 x 18 foot pattern is used at the mines. The holes are then loaded with an ammonium nitrate-fuel oil (ANFO) mixture, primed, and detonated using primacord. After shooting, drilling begins in the next section. The size of the section that is drilled and shot depends on the method of overburden removal.

The area strip mining technique is used for overburden removal at Energy 1 mine. Overburden is presently being stripped to 60 and 70-foot highwalls with a dragline equipped with a 14-yard bucket, and another with a 21-yard bucket, respectively. Following blasting of the overburden, the shot material is leveled and a bench is prepared for the dragline by caterpillar bulldozers. The dragline works from this bench, casting the shot material into the previous mined-out pit, or during the first or box cut, onto previously undisturbed ground. As the coal is uncovered from a particular bench by the dragline, the highwall is scaled by the bucket and is also dragged with a heavy chain attached to the bucket prior to moving to the next bench. This helps prevent loose material from falling on pit crews which follow to mine the coal. After each section of shot material is removed and cast aside, exposing the coal seam, the dragline moves up the slope to the next section of blasted overburden. Both strike line and dip line forms of mining will continue to be employed at the Energy 1 mine. Although most recent mining has been dip line form, initiation of operations to the southwest of present operations will be strike line mining. An additional dragline has been ordered and is scheduled for delivery in September, 1975. This machine will be equipped with a 55-yard bucket and a 325-foot boom. When erected and operational in late 1976, it will be capable of stripping coal seams to an overburden depth of 120 feet. It will first work around the perimeter of Energy 1 mine removing overburden from the standing 60-70 foot highwall levels to its 120-foot capacity. Then it will move downdip to the other dragline operation, which will have moved to the southwest by this time.

The pits at Energy 1 mine are at present carried on a width of 85 feet and extend up the pitch of the coal seam from the 60 or 70-foot highwall to the outcrop at the top of the hill. Overburden removal is conducted on a three shift/day, seven day/week schedule.

Overburden is removed at Energy 2 mine with two small 7 1/2-yard draglines and a fleet of D-9 caterpillars and scrapers. The additional flexibility of the rubber-tired and crawler mounted equipment is used to strip coal with erratic overburden depths and irregular surface topography where dragline access would prove very difficult, and therefore inefficient. Stripping is done along the strike of the coal bed at Energy 2 mine and progresses up the dip of the coal bed toward the east. The 7 1/2-yard draglines are employed in a conventional area strip mining technique. The scrapers excavate overburden in a series of narrow, shallow pits. Overburden is moved to a previously undisturbed area during excavation of the first pit, and to the previous mined-out pit during subsequent excavations.

Overburden is removed at Energy 3 mine with a fleet of scrapers. Coal mining operations consist of a series of narrow, shallow pits. The continuous line of successive pits are necessarily scraper operations because of the excessive dip of the coal bed; the steep dip prevents the development of the long slopes needed for major dragline operations. The company may in the future supplement the scraper units with a truck and shovel operation.

Coal removal

Coal removal is accomplished at all three mines in much the same way. The surface of the exposed coal in the pit is cleaned off, and then 2 1/4" holes are drilled to the base of the coal on 10' x 5' centers. These holes are then loaded with ANFO, and a stick of NOTRO-STARCH, and shot with primacord. Coal excavation is accomplished with rubber-tired, front-end loaders. These loaders fill off-highway haulage trucks for the one-two mile journey to the dumping facility. The coal is dumped into a bin which feeds the primary crusher. Coal loading and haulage are performed on a three-shift/day, six-day/week schedule.

Reclamation

The following reclamation plan deals with each mining area separately. Reclamation varies by site due to difference in topography, land use, soils, and vegetation types on the three areas. Practices that apply to all sites will follow the discussion on the individual areas. See Chapter III for past and current reclamation at the Energy Mines. This reclamation plan applys to current Federal and State leases held by Energy Fuels Company, and would be applied to any future leases acquired in the three mining areas.

Energy 1 mine

Energy 1, the original mine area, has some of the spoils dating back to 1962. The area lies between 6,900 feet-7,600 feet elevation and receives 15-20 inches of annual precipitation, mainly in the form of snow. Vegetation occurring in this area is primarily mountain-shrub, aspen, and sagebrush communities with some grain fields; the area lies predominately on a north-facing slope. The proposed use for this area after reclamation will be grazing land for wildlife and domestic livestock.

Spoil piles will be reshaped with track-mounted dozers to approximate original contours, after there are two overburden piles away from the cut. Eight-eighteen inches of topsoil will be replaced with scrapers on the reshaped area. After topsoil is replaced, it will be shaped, disced, harrowed, and seeded. Where possible, shrubs and trees will be relocated with a front-end loader from areas to be mined to areas which are being revegetated. Energy Fuels Corporation is also reclaiming the spoils from the old mining operation. This consists of leveling and reshaping the spoils to approximate original contour, and replacing topsoil to a depth of four-six inches when excess topsoil is available from newly mined areas. The area will then be disced, harrowed, and reseeded. Trees and shrubs will also be transplanted to this area.

Energy 2 mine

Energy 2 starts on the east bank of Fish Creek and continues up-slope. The area lies on a northwest-facing slope between 6,700-7,300 feet in elevation. Precipitation is the same as Energy 1, and the vegetation is primarily a sagebrush community on a shallow clay type soil.

The proposed use for this area after mining is cropland and will primarily consist of the production of small grain crops. Overburden shaping will be done in the same manner as Energy 1 except where overburden is shallow and removed by scrapers. In these operations spoil material will be placed in its final shape by scrapers. Topsoil will be replaced, prepared, and seeded as at Energy 1 on a continual basis or from stockpiles. Time lag between stripping and reclamation will be approximately one year.

Energy 3 mine

Energy 3 lies between Fish and Foidel Creeks. The area lies between 6,600-7,000 feet elevation and receives 15-20 inches of annual precipitation; it is primarily sagebrush community on a clay type soil. This area will be reclaimed to either farmland or grazing land for wildlife and livestock depending upon site specific conditions, mostly topography.

Since the pullback mining method will be utilized at the mine all topsoil will be stockpiled. After the coal has been removed the overburden will be replaced by trucks or scrapers and only a minimal amount of regrading will be required. Topsoil will be replaced from the stockpiles, prepared, and reseeded as at Energy 1.

Practices utilized at all mines

To the extent possible, shaping will be accomplished in a manner which will blend the reclaimed land with the surrounding natural topography, thus lessening the overall scenic impact on the projected area.

Reshaping the slopes will be accomplished with tractors and scrapers, and topsoil will be replaced with rubber-tired scrapers. Grade stakes will be used to facilitate topsoil depth measurements. Topsoil will be smoothed with tractors using drag chains and rail ties. It will be disced or chiseled to create a suitable seed-bed, and then harrowed. The degree of leveling and roughening will be determined by use; for example, on land reclaimed for grazing, it may be desirable to roughen the surface more to create a diverse microclimate for a better vegetative cover. However leveling of replaced topsoil on land reclaimed to farmland is very desirable and necessary to produce a favorable surface for crop production.

Seeding will be accomplished with a drill where topography is amenable to farm machinery, and seeds will be drilled to a depth of one-half to three-fourths inch. At present the following species are planted on all affected areas: intermediate wheatgrass (Agropyron intermedium), smooth brome (Bromus inermis), orchard grass (Dactylis glomerata), and alfalfa (Medicago sativa). Seeding rates of 8:4:2:2 pounds pure live seed/acre will be used; on broadcast seeded areas these rates will be doubled. Additional and/or alternate species will be utilized as site, use, and supply indicate. Seeding will be conducted preferably in fall or early spring. Where reclamation is to achieve range type conditions, native shrubs and trees will be transplanted with a front-end loader and/or by hand. Transplanting will be carried out when species are dormant. Planting of some introduced trees and shrubs will be conducted on a site specific basis.

If weeds start to invade areas reclaimed for cropland, control will be conducted by either mechanical or chemical methods, depending on the area and severity.

It is anticipated that mulch will not be required on most surfaces to be reclaimed; however, hydromulching may be used on areas with steep slopes, but these areas would be minimal.

Experiments with wood chips and straw will be conducted on small tracts to facilitate reclamation on areas of adverse soil and/or moisture conditions.

Soil samples will be taken randomly on sites that have been reshaped and topsoiled. These samples will be submitted to the soil laboratory at Colorado State University for analysis and fertilizer recommendations. Recommended fertilizer applications will be applied in early spring following the first growing season.

Topsoil will be removed from areas to be mined and applied directly to areas to be reclaimed where feasible. It will be stockpiled when the mining sequence, or soil moisture and temperature conditions do not permit immediate placement. When it is stockpiled it will be segregated from any spoil material; furrows will be constructed at the slope toe to prevent possible water contamination. Topsoil piles will be roughened and seeded with a fast-growing plant to facilitate moisture retention, decrease erosion, and nutrient leaching.

No overburden bore holes have been sampled to date, but plans are being made to sample and analyze strata during the summer of 1975. The results of these analyses will be helpful in determining the best methods for overburden segregation if required.

All overburden shaping will be accomplished on a slope calculated to minimize erosion and sedimentation, prevent landslides, and control flooding. Contour furrows will be made at the slope toe of topsoil and overburden piles to trap sediment.

All toxic material, debris, refuse, or material constituting a fire hazard will be buried in the pits in a manner to prevent contamination of ground or surface water.

The four streams in the present mining area will be monitored; they will be sampled monthly above, below, and within the mine areas as weather permits. Any surface water generated into the pits will be pumped into evaporation ponds. This monitoring program will be used to check the possibility of downstream contamination and to comply with standards set by the Colorado Water Quality Commission.

Miscellaneous practices

Warning signs will be placed around all areas which might constitute a threat to human safety. All haul roads will be watered to control fugitive dust in compliance with air pollution standards set by the Colorado Air Pollution Control Commission.

All reclaimed areas will be fenced with a livestock-proof fence. Reclaimed areas will be restricted to grazing until after the second growing season, at which time grazing will be permitted on a limited and regulated basis with the approval of the Open Mine Land Board's recommendation.

All appropriate governmental and private agencies will be consulted as necessary to accomplish the best possible and most economical reclamation.

Surface facilities

In order to support the mining operation and provide a marketable coal product, related auxiliary facilities and services are required; these facilities are described hereafter. All of the company's surface facilities are constructed on private surface land.

Roads

All haul roads at Energy 1 mine are constructed on the bottom of the pit or on regraded spoils. The company has recently moved Routt County Road 27 to go around its operations and increase its strippable reserves. Haul roads at Energy 2 are generally located on the bottom of the pit or across land on the up-dip side of the pit that will be mined in the future.

Railroad spur and coal loading

Access to coal preparation plants and markets is provided by a 12-mile spur line of the Denver and Rio Grande Western (D&RGW) railroad from Milner, Colorado. Unit-trains of specific size are gravity-loaded from the coal stockpile. Coal is loaded into railroad cars passing through a tunnel at one location and beneath a loadout bin at the other two unit-train facilities. The older plant near Energy 1 mine, now infrequently used, crushes and loads directly into cars which are moved by a tugger hoist. The new loading facility serving Energy 1 and 2 mines has a loading rate of approximately 2,000 tons/hour. Also, the facility at the Energy 3 mine has a load-out rate of 2,000 tons/hour.

Power

Electric power for the mine shops, electric draglines, crushing station, and loading facilities is supplied to Energy 1 and 2 mines from an existing 69-kv transmission line; power to the Energy 3 mine has been attained through rerouting an existing 69-kv transmission line on private lands.

Crushing plants

Three two-stage crushing and screening plants are available at the company's mines. Two of these are in close proximity to the Energy 1 and 2 mines. The older of these two plants has a capability of processing 500 tons of coal/hour, while the second plant, operating together with the new unit-train loading facility, is operating at rates of 1,800 tons/hour. The third crushing plant is located at the Energy 3 mine and has a crushing capacity of 500 tons/hour.

Crushed coal storage

A total combined storage capacity of 145,000 tons of sized coal is available at the three unit-train loading facilities. Of this total, approximately 50,000 tons are live (active) and are available for unit train load-out. Unit-trains of 58, 44, or 40 cars are loaded at the various facilities; present haulage profiles over the Rocky Mountain front range corridor limit the size of the unit-trains to 58 cars.

Office complex and maintenance facilities

The office complex, shop, and warehouse are located on private land in Sections 29 and 32, T.5N., R.86W. Administrative, payroll, and staff personnel are housed in offices near the shop. Basic mine scheduling, reclamation, and safety activities are coordinated by a resident staff. Heavy mobile equipment, such as drills, front-end loaders, haulage units, and dozers are generally taken to the newly constructed maintenance facility for servicing and repairs. Five large bays, equipped with overhead mobile and floor-mounted stationary cranes, are available to accommodate all heavy equipment taken into the shop. A warehouse building adjacent to the shop complex provides storage for operating supplies and repair parts.

Mining, loading, and reclamation equipment

Table EI-1 contains a summary of the company's current equipment fleet and equipment now on order.

Mining sequence

Present mining operations will continue at all three of Energy Fuel's pits. Mining will continue north and, west at the present Energy Strip 1

TABLE EI-1

Current Equipment Fleets

Fleet	Number	Capacity
Dozers	9	--
	1	--
	5	--
	1	--
	1	--
Total Units	17	
Haulage Trucks	4	65-Ton
	8	50-Ton
	2	35-Ton
Total Units	14	
Draglines	1	21-Yard
	1	14-Yard
	2	7 1/2-Yard
Total Units	4	
Overburden Drills	1	9-Inch
	3	7 7/8"
Total Units	4	

Fleet	Number	Capacity
Coal Drills	4	2 1/2"
Total Units	4	
Coal Loading Units	1	14-Yard
	2	10-Yard
	2	7-Yard
Total Units	5	
Road Graders	2	--
Total Units	2	
Scrapers	2	14-Yard
Total Units	2	
Water Trucks	1	--
Total Units	1	
Fuel Trucks	1	--
Total Units	1	
Lubrication Trucks	2	--
Total Units	2	

Equipment on Order

Fleet	Number	Capacity	Estimated Delivery Date
Dragline *	1	55-Yard	September 1975
Overburden Drill	1	9-Inch	March 1976

* Second on order for 1979

mine. The 14-yard and 21-yard draglines will remove overburden to their respective depth limits of 60 and 70 feet. When the new 55-yard dragline becomes operational in late 1976, it will work around the perimeter of the Energy 1 mine, removing overburden from the existing 60-foot to 70-foot highwall level to its capacity of 120 feet. Mining operations will also expand southwest with the 14-yard dragline opening a new boxcut in Section 17, T.4N., R.86W., as depicted in Figure EI-2. This machine will work its way across Section 17 into Section 18 where it will concentrate on removing overburden up to a 60-foot highwall during the next five years. The 21-yard dragline will follow the 14-yard dragline into Section 17 and will work in an adjacent area east of the 14-yarder, cleaning up both Sections 17 and 18 to the Wadge cropline in an area where stripping depths commonly exceed 60 feet. By 1979, the present Energy Strip 1 pit in Sections 32 and 33, T.5N., R.86W. will be mined out and all mining at Energy 1 will be confined to Sections 8, 17, and 18, T.4N., R.86W. By 1980, this area will also be mined out, and operations will again need to be expanded southwest into Sections 18 and 19, T.4N., R.86W. on Federal land for which Energy Fuels has made lease application.

Mining operations at Energy Strip 2 have expanded from private land in Sections 24 and 25, T.5N., R.87W. into Federal lease land in Sections 19 and 30, T.5N., R.86W. The company has also made application for additional Federal land in Sections 25 and 19 to be mined in conjunction with currently held lands. The company has filed an application for Federal land in Sections 27 and 28, T.5N., R.86W. and Section 36, T.5N., R.86W., which, if acquired, should extend the life of the Energy 2 mine by at least two years into the early 1980's. The mine sequence is depicted in Figure EI-2.

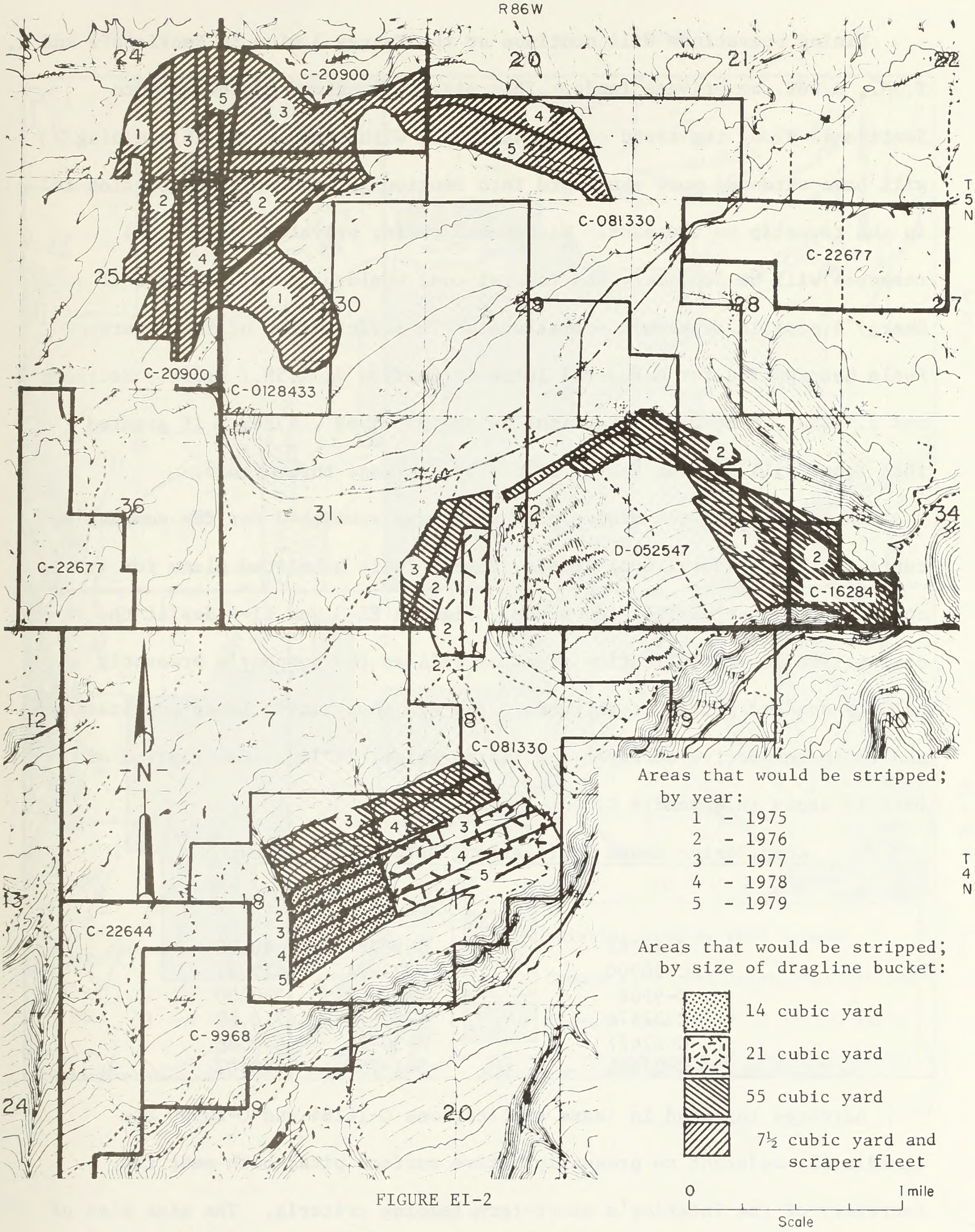


FIGURE EI-2

Mine sequence map for Energy 1 and Energy 2 mines.

Mining operations will continue at the Energy 3 mine in Sections 1 and 2, T.5N., R.86W. on private lands. This mine will extend southward into Section 12 along the trend of the outcrop. Within two years this mining will have extended more southward into Section 13, and adjacent Section 18 in the township to the east. Within 4-5 years, privately owned coal reserves will be depleted, and Federal coal would have to be leased if Energy 3 mine is to remain operational. In anticipation of this Energy Fuels has applied for a Federal lease in Section 7, T.5N., R.85W.; Sections 2 and 3, T.5N., R.86W.; and Sections 34 and 35, T.6N., R.86W.; if granted this lease will prolong Energy 3 life by at least three years.

In addition to the mining plan which was submitted for the company's currently held Federal coal leases, Energy Fuels submitted plans for its competitive lease application areas. Figures EI-3 and EI-4 depict the competitive lease application areas as well as the company's presently held leases and private coal lands. The six competitive lease applications and their respective acreages are listed below. A legal description of each is shown in Appendix D.

Competitive Lease Application	Date Filed	Acreage
C-16284	5-9-72	80.00
C-20900	5-23-74	419.87
C-9968	11-7-69	320.00
C-22676	4-30-75	716.10
C-22677	4-30-75	644.26
C-22644	5-1-75	678.02

Acreages included in lease applications C-16284 and C-20900 are immediately adjacent to presently active surface pits; both meet the Secretary of the Interior's short-term leasing criteria. The mine plan of

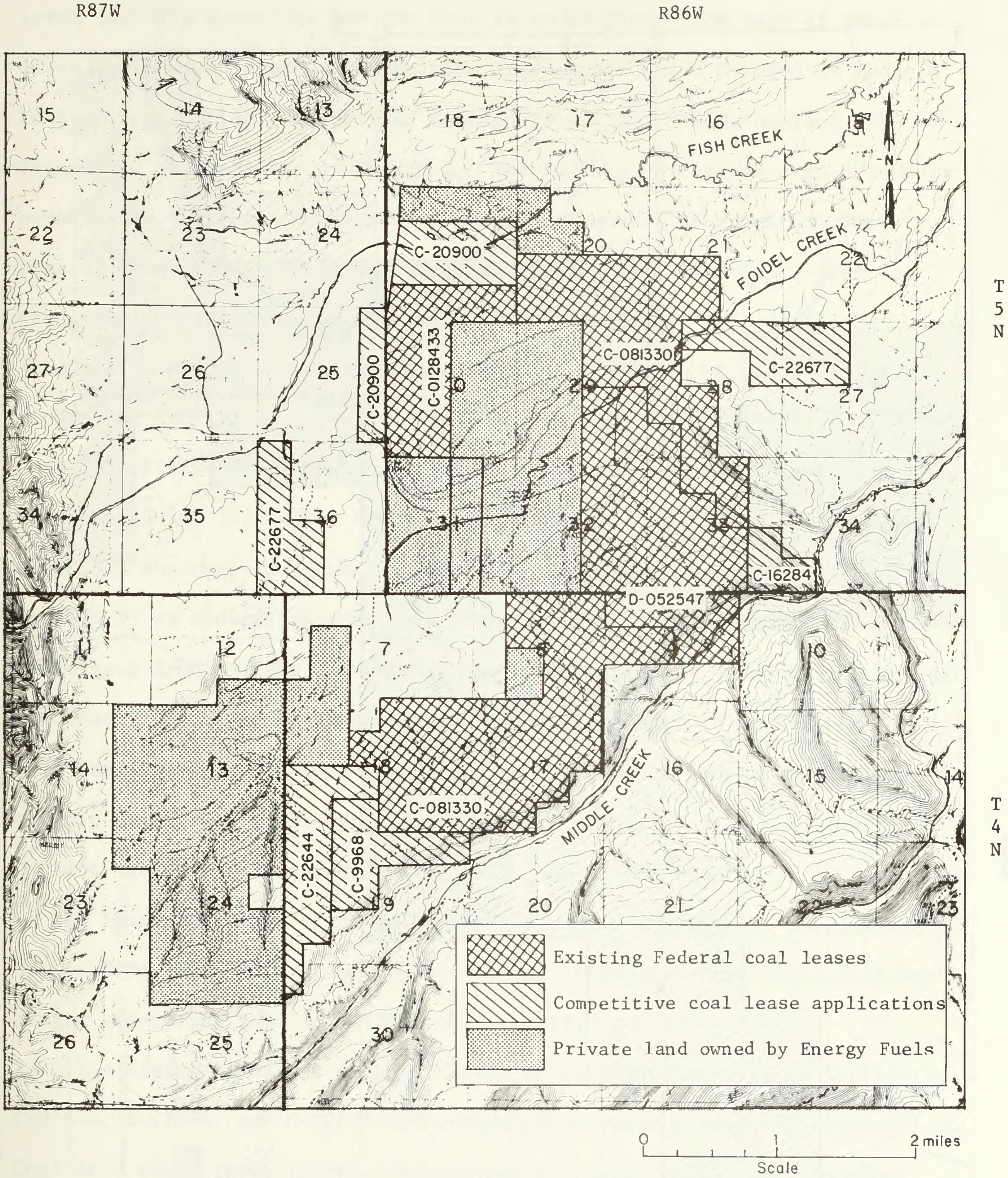


FIGURE EI-3

Energy Fuels Corporation's currently held Federal coal leases and competitive lease application tracts in the Energy 1 and Energy 2 mine areas.

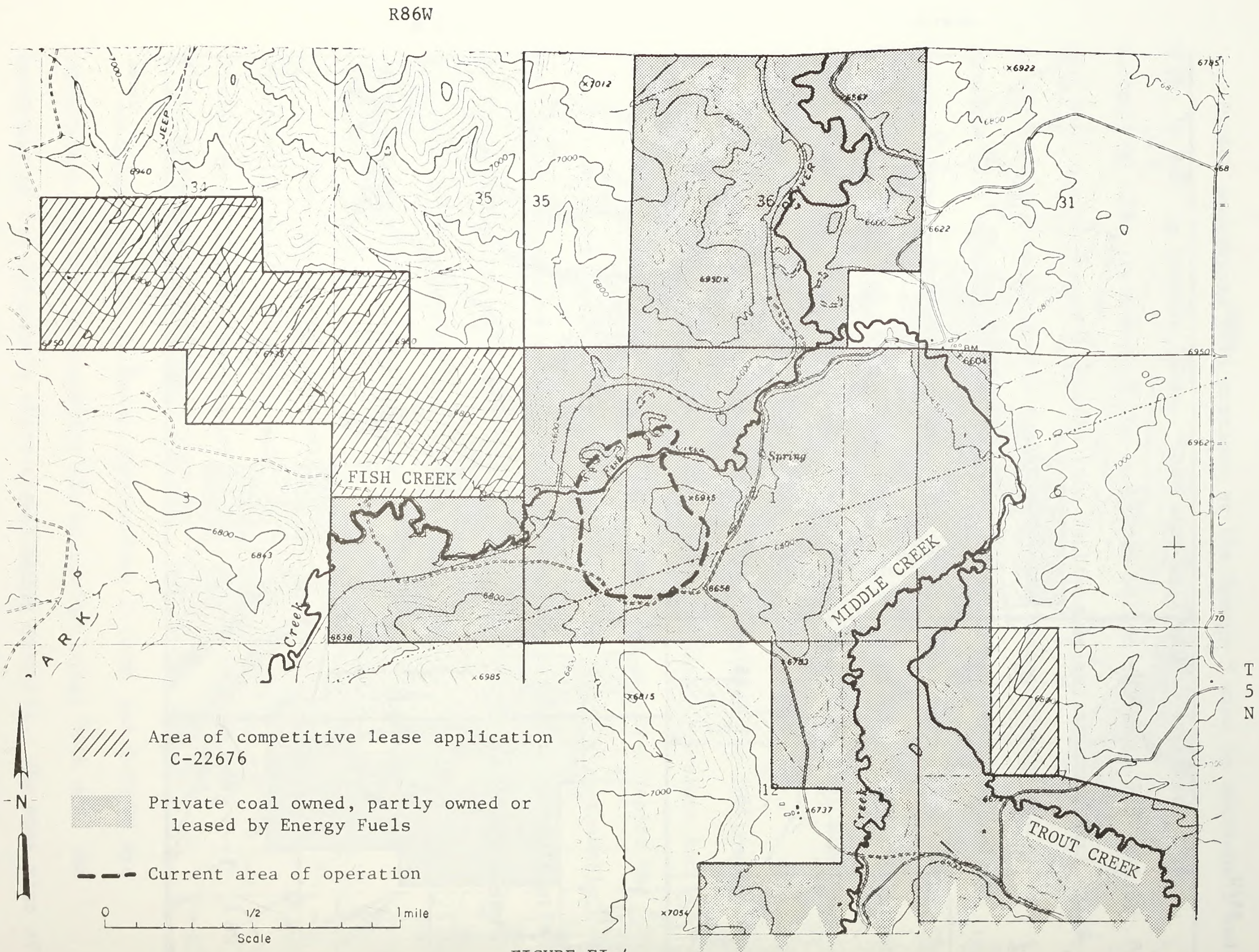

R86W
T 5 N
31
35
35
36
31
6
1
12
FISH CREEK
MIDDLE CREEK
TROUT CREEK
Creek
Spring
JEEP
PARK
Area of competitive lease application C-22676
Private coal owned, partly owned or leased by Energy Fuels
Current area of operation
N
0
1/2
1 mile
Scale

FIGURE EI-4

Energy Fuels Corporation's competitive lease application tract in the Energy 3 area.

April 30, 1975 describes how the coal is to be mined from each of these lease application areas. Competitive lease application C-20900 is located in Section 19, T.5N., R.86W. and Section 25, T.5N., R.87W. on land contiguous to present pits at Energy 2. The surface of this land is privately owned while the coal is reserved to the government. If acquired, the company plans on stripping coal from this lease area with two 7-yard draglines, supplemented by a scraper and dozer fleet. A production schedule submitted by the company shows that a portion of the coal lying within the Section 25 parcel is proposed to be mined in 1975.

Competitive lease application C-16284 lies adjacent to Energy 1 in Sections 33 and 34, T.5N., R.86W. The surface of Section 33 is privately owned and the coal is federally owned, while both surface and coal in Section 34 is federally owned. This acreage is a continuation of the Wadge seam down a steep downwarp of the strata into the Twentymile synclinal structure. The mine plans show the coal in this tract to be stripped in 1976 and 1977 by the new 55-yard dragline. Pits will generally be along the dip of the bed. The dragline will enter the tract from coal lease D-052547 which lies adjacent to the west side of the tract. In anticipation of the leasing of this tract to Energy Fuels, the company has moved Routt County Road 27 to go around its operations; access is thereby attained for mining underlying coal to a 120-foot highwall.

The mining plans for each of Energy Fuels competitive lease applications C-22644, C-22676, and C-22677 are described in their respective applications. Coal from these three leases, if acquired by Energy Fuels, will be mined for the most part during the period 1980-1990.

Competitive coal lease applications C-22644 and C-9968 are located in Sections 18, 19, and 30, T.4N., R.86W. on land that borders present lease C-081330. The surface of the land is privately owned and the coal federally owned. If the leases are acquired, the company will open a boxcut in Section 18 with the 14-yard dragline; mining would then progress into Section 19. A strike line form of the area strip mining method would be employed. The 14-yard dragline will be excavating overburden in coal lease C-081330 until 1980, so would not be available for stripping in the application areas until that time. Prior to the start of operations in these lease application areas, a new five year plan would be prepared.

Competitive lease application C-22676, which meets the Secretary's short term criteria, is located in Section 7, T.5N., R.85W., Sections 2 and 3, T.5N., R.86W., and Sections 34 and 35, T.6N., R.86W. on privately held surface land and Federal coal. This lease application lies adjacent to privately owned or leased coal of Energy 3 mine. Coal mining operations could extend south and northwest of the present pit with successful bidding and acquisition of this lease application by Energy Fuels. The lease areas, if acquired, would be mined in a method similar to that now used at 3 mine. Scrapers remove the overburden in a series of narrow, shallow pits and deposit it in the previous mined-out pit. The extreme dip of the coal in the area precludes economic stripping with a dragline. In the future the company may supplement scrapers with a truck and shovel operation. The acquisition of this lease tract would extend the life of the Energy 3 mine by at least three years. Mining is scheduled to begin on the lease application area in 1979, if acquired by that time.

Competitive lease application C-22677 is located in Sections 27 and 28, T.5N., R.86W., and in Section 36, T.5N., R.87W. All of the land encompassed in this application is privately owned surface and Federal coal. The areas requested to be put up for public auction are considered probable strip areas on the Fish Creek coal seam. The company is presently mining the Fish Creek seam at Energy 2 mine in Sections 24 and 25, T.5N., R.87W., and Sections 19 and 30, T.5N., R.86W. Overburden removal is accomplished with two 7 1/2-yard draglines and a fleet of five D-9 caterpillars. If this area is put up for auction and Energy Fuels is the successful bidder, the company will mine the lease application areas in a similar manner to the present Energy 2 mine.

Transportation and marketing

Coal is loaded from the storage areas directly into 40, 44, or 58 car unit-trains for shipment to market. Public Service Company of Colorado currently receives 80 percent of Energy Fuels production. Energy Fuels is scheduled to ship 2,750,000 tons of coal to Public Service Company during the fiscal year ending March 31, 1976. Most of the remainder of Energy Fuels' scheduled 1975 production will be shipped to St. Louis to Amherst Industries, Inc., a West Virginia-based marketing firm; Energy Fuels is contracted to supply 475,000 tons of coal to Amherst in the 1975-76 fiscal year. Additional small amounts of coal are shipped elsewhere.

Relationship to Other Developments in Immediate Area

There are presently three other coal operators actively mining coal in the immediate vicinity. Pittsburg and Midway Coal Mining Company is mining coal from Edna Strip Mine located three miles east of Energy 1 mine. Routt Mining Corporation has a small underground operation three miles south of Energy 1 mine. Peabody Coal Company is presently mining at Seneca 2 about eight miles northwest of Energy 1. Peabody's Seneca 2-W mine area, scheduled to begin operation in the near future, is located approximately 13 miles northwest of Energy 1 mine. These operations are little related as they serve different markets and do not lie immediately adjacent to one another. Energy Fuels and Pittsburg and Midway use separate spur trackage, but the same railroad (D&RGW), for transportation of their coal over the Rocky Mountains; however the railroad can adequately handle increased volume of traffic. Expansion of Energy Fuels' mining operations should have little effect on the other coal producers in the immediate area.

Several companies and individuals have indicated their intent to begin coal mining operations in the vicinity of Energy Fuels in the very near future or within the next few years. Thomas Woodward and Paul Coupey both plan mining operations on private land three miles northeast of Energy 3 mine. Mapco Incorporated owns a large State lease immediately north of Energy 1 and 2 complex. Coal Fuels Corporation has made application for a Federal lease located five-eight miles northwest of Energy 1 with intentions of opening a large underground mine. Energy Fuels' continued operation and expansion should have little effect on these proposed developments.

Four existing and two proposed transmission lines pass through the immediate Energy Fuels area. A 230-kv transmission line currently passes through Energy 3 vicinity. The proposed Hayden-Ault 345-kv transmission line will pass through this same corridor. The 230-kv Hayden-Toponas line and the 138-kv Hayden-Oak Creek line pass through Energy Fuels competitive lease application C-22677 area. In addition the proposed 230-kv Hayden-Wolcott transmission line will pass through this corridor. A 69-kv Yampa Valley Electric Association line passes through Energy Fuels Federal leases C-081330 and D-052547; this line will be rerouted to circumvent planned expansion of the Energy 1 mine. It is the usual procedure in areas where transmission lines and strip pits conflict to reroute the transmission line; in some instances, the utility company may be forced to compensate the mining operator for coal that is lost by failure to reroute the line.

Chapter II

Description of the Environment

THE FOLLOWING SECTION DESCRIBES THE PHYSICAL, BIOLOGICAL, AND CULTURAL RESOURCE VALUES WHICH CONSTITUTE THE SITE-SPECIFIC ENVIRONMENT IN WHICH ENERGY FUELS CORPORATION PROPOSES TO DEVELOP FEDERAL COAL. ALTERATIONS OF THESE EXISTING RESOURCE VALUES WOULD RESULT FROM THE IMPLEMENTATION OF THE CORPORATION'S PROPOSAL. ADDITIONAL EMPHASIS IS GIVEN TO A DESCRIPTION OF THOSE ENVIRONMENTAL COMPONENTS WHICH MAY BE IMPACTED BY ALTERNATIVES TO ENERGY FUELS CORPORATION'S PROPOSED ACTION DESCRIBED IN CHAPTER VIII.

CHAPTER II

DESCRIPTION OF THE ENVIRONMENT

Non-living Components

Geologic and Geographic Setting

Topography

Energy Fuels Corporation's Number 1 surface mine, lease C-081330 (partly) and lease application C-9968 to the southwest, occupy a long high ridge. This ridge trends northeasterly and its crest drops from 8,200 feet elevation at the southwest end of lease application C-9968, to about 7,400 feet at the northeast end in lease application C-16284. The ridge has a steep southeast escarpment ending at Middle Creek at an elevation of about 7,000-7,300 feet; this escarpment is 450-600 feet high and drops an average of 300-400 feet/1,000 feet horizontally. The northwest slope is gently and uniformly northwest-sloping to Foidel Creek; distance from the ridge crest to Foidel Creek is 1.5-1.7 miles; this gentle slope drops about 800 feet in this distance. West of Energy 1, Foidel Creek is forced to turn abruptly northward before continuing to the northeast, by Pinnacle Peak (7,400 feet), a 450-foot high butte capped by an erosion remnant of the Twentymile Sandstone Member.

Foidel Creek flows northeast to join Middle Creek about five miles from the Energy 1 mine. Foidel Creek is at the southeast base of the escarpment of a ridge that is similar and parallel to, and slightly lower than, the one just described. This ridge also has a more gentle slope to the northwest, averaging about 400-500 feet/mile. This gentle slope terminates at northeasterly-flowing Fish Creek, about 1.1-1.8 miles from the ridge crest; the ridge crest is at about 7,400 feet elevation and Fish Creek at about 6,750-6,800 feet. The county road from Oak Creek to the Hayden power plant goes through a gap in this ridge near the west edge of the company's lease area.

Energy 2 mine is operating on the northwest foot of this ridge, along Fish Creek. The gentle slope merges into the open and gently undulating upper part of Twentymile Park. Lease applications C-2900, C-0128433, C-22677, and part of C-081330 occupy part of this edge of Twentymile Park.

The ridge terminates near the common corner of Sections 20, 21, 28, and 29, T.5N., R.86W.; here Foidel Creek has cut a narrow gap between the end of the ridge and a 400-foot high, sharp, southeasterly-trending ridge that is 1.5 miles long. The railroad spur from Energy 1 and the county road also go through this narrow gap. Lease C-081330 occupies part of the southeasterly-trending ridge.

Middle Creek occupies a narrow valley; the valley of Foidel Creek is somewhat wider, and Fish Creek is a meandering stream in a much wider and flatter valley, except in Section 19, T.5N., R.86W. where it meanders in a more restricted valley.

Energy 3 and adjacent lease application C-22676 occupy a hilly area; Fish Creek meanders through it from southwest to northeast in a relatively wide flat valley. Small oxbow lakes occupy part of the floodplain of Fish Creek in Sections 1 and 2, T.5N., R.86W., and Section 36, T.6N., R.86W. The hilly areas comprise three ridge lines trending northwesterly, and in general have a steeper northeast slope and slightly more gentle southwest slope. Foidel Creek drops from about 6,620 feet to about 6,550 feet across the area.

Elevation in Energy 3 mine area ranges from about 6,700-6,915 feet; the highest elevation in the area is 7,290 feet in the northwest part. Average relief of the area except for Fish Creek valley is about 200 feet in 1,500 feet, and the maximum is 200 feet in 500 feet (center S 1/2 Section 36).

Stratigraphy

Except for surficial deposits, only the coal-bearing Mesaverde Group and overlying Lewis Shale are at the surface in the area of this report (Bass, Eby, and Campbell 1956). A brief report on stratigraphy of the Steamboat Springs area by T.G. Larson (1955) describes rocks down to Precambrian, mostly from an oil test hole at Tow Creek (sec. 18, T.6N., R.86W.). Stratigraphy is discussed in Description of the Environment, of the Regional Analysis of this Environmental Impact Statement. Figure EII-1 shows the pertinent part of the coal-bearing rocks, and Table EII-1 shows the subsurface stratigraphy as described by Larson (1955).

The only coal-bearing strata in the area are the Iles and Williams Fork Formations of the Mesaverde Group (Figure EII-1). Only beds of the Williams Fork Formation are at the surface, except along Middle Creek (E 1/2 and E 1/2 SW 1/4, Section 9; SE 1/4 and SE 1/4 SW 1/4 Section 17; and E 1/2 and SE 1/4 SW 1/4 Section 19, T.4N., R.86W.). The Iles Formation underlies the Williams Fork. The coal currently being mined at Energy Fuels 1 mine is the Wadge coal bed of the middle coal group, and the mined bed at Energy 2 mine is the Fish Creek coal bed of the upper coal group, both of the Williams Fork Formation.

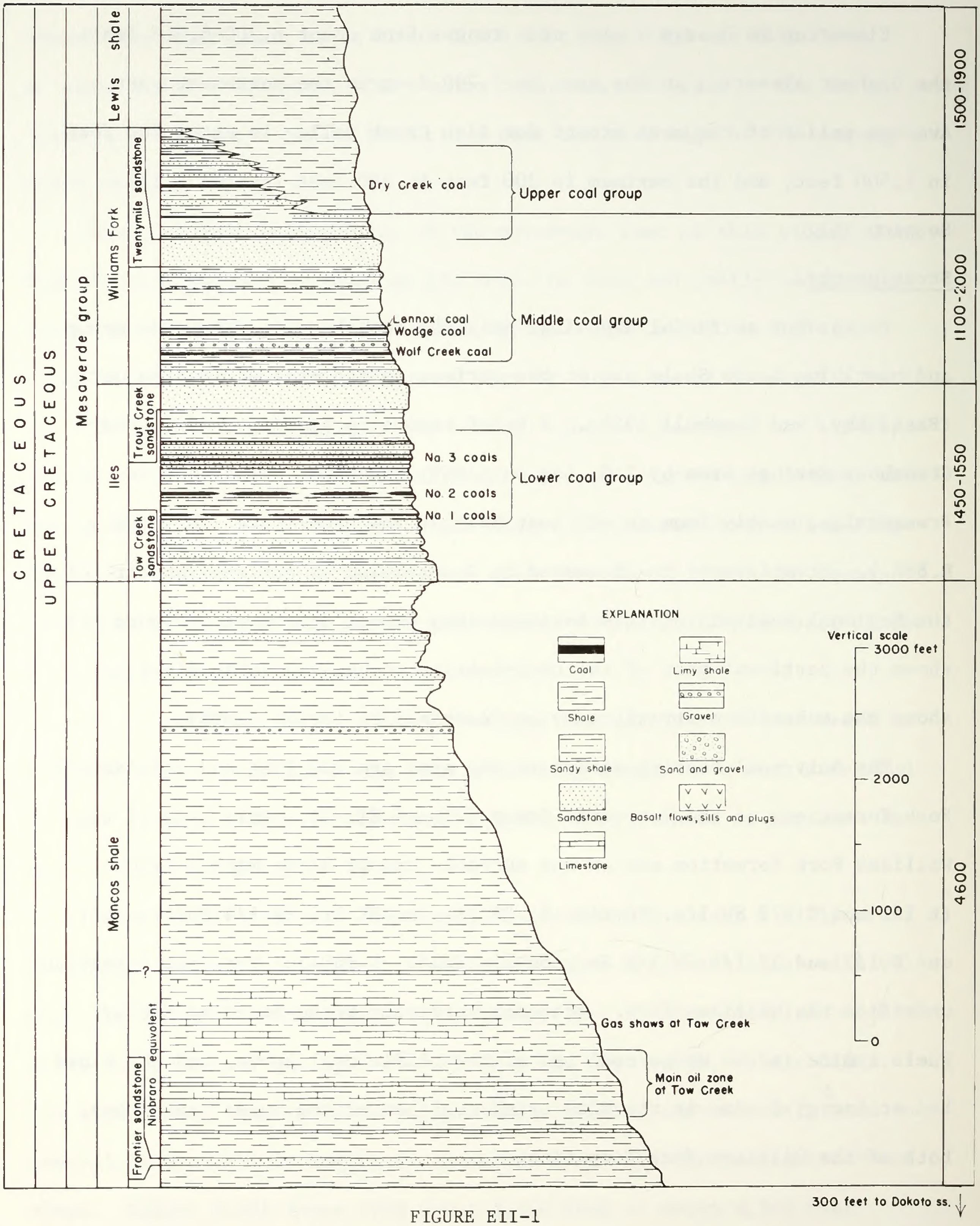


FIGURE EII-1

Coal-bearing formations in Energy 1, 2, and 3 mine areas.

SOURCE: U.S. Geological Survey Bulletin 1027

TABLE EII-1

Pre-Mesaverde Formations

Formation Name	Age	Description	Thickness (feet)
Mancos Shale	Late Cretaceous	Shale, gray, partly sandy; some sandstone beds near top. Includes Niobrara Fm. Equivalent, 800-900 ft. calcareous shale; Frontier Fm. equivalent, about 50 ft. calcareous sandstone; and, at base, Mowry Shale equivalent, siliceous shale.	5,000
Dakota Sandstone	Early Cretaceous	Sandstone, massive, non-calcareous, fine-grained, has lenses of coarse sandstone and conglomerate, usually hard and with siliceous cement. Some carbonaceous material.	150
Morrison Formation	Late Jurassic	Mostly variegated green, gray and maroon shale; some thin beds of limestone, lenses of chert, and white sandstone near base.	300
Entrada Sandstone	Late Jurassic	Sandstone, massive beds, fine-to-medium-grained, light gray.	200
Chinle Formation	Late Triassic	Shale, mudstone, and fine-grained sandstone, red with some brown, yellow, gray, and purple.	230
Garta Member of Chinle Formation (Formerly Shinarump)	Late Triassic	Conglomerate and sandstone; mainly varicolored quartz grains from medium sand to pebbles one-half inch in diameter.	73
Moenkopi Formation (lowest penetrated in drill hole)	Early Triassic	Dull red sandy shale, sandstone, siltstone, and some greenish gray and yellow shales. Stringers of gypsum in lower part.	463
Maroon Formation		Arkosic redbeds overlying Precambrian rocks near Steamboat Springs.	±300

SOURCE: Larson 1955 (modified).

The Trout Creek Sandstone Member of the Iles Formation, a cliff-forming white sandstone about 100 feet thick, lies just below the Williams Fork. The Twentymile Sandstone Member of the Williams Fork Formation, a 100-200 foot-thick, white, cliff-forming sandstone bed, is near the top of the formation and separates the middle coal group from the upper coal group. These two prominent sandstone beds form excellent stratigraphic markers throughout this coal-bearing area.

About 1,000 feet of strata constitute the Williams Fork Formation below the Twentymile Sandstone Member. These strata include several coal beds, the most important of which are the Wolf Creek, Wadge, and Lennox. The lower half of this unit of the formation consists mostly of soft and thin-bedded sandstone, sandy siltstones, coal beds, and thin beds of dark gray to black shale. The upper half is mostly siltstones interbedded with sandstone beds.

Above the Twentymile Sandstone Member is a unit about 200 feet thick that constitutes the upper part of the formation. This unit consists of sandstone, sandy shale, dark gray shale, and one coal bed, the Fish Creek coal bed, which is about 3-4 1/2 feet thick. This upper unit interfingers laterally with the overlying Lewis Shale, a formation of marine origin and non-coal-bearing.

Alluvium of Quaternary age is present mostly along the main streams; its thickness and nature are not well known; it consists mainly of sand, silt, and lesser amounts of gravel.

Structure

Energy 1 mine and lease application areas to the southwest are on the northwest flank of a north-northwest plunging asymmetrical anticline, the Trout Creek (formerly Oak Creek) anticline. The anticlinal axis skirts the east edge of the present mine area. Beds on the flank of the anticline at Energy 1 mine dip about 15° on the average; however, they vary from about 8°-16° in dip. An axis of the Twentymile syncline trends northwestward through Sections 21 and 27, T.5N., R.86W. Another synclinal axis trends due north, about one mile west of the lease area of Energy 1 mine, then swings northeast just outside the area of Energy 2 mine to join the other eastern synclinal axis and continue northward as the Twentymile Park syncline. Dip of the beds in the Energy 2 mine area is low, averaging about 3-5°.

At the Energy 1 mine and southwest, the northwest flank of Trout Creek anticline is broken by at least ten northwest-trending normal faults, almost all down-thrown on the southwest side. However, one or more faults are down-dropped to the northeast. Vertical displacement ranges from less than one to possibly more than 50 feet. These faults "were mapped in the field by Campbell and were later somewhat modified by Bass. It is probable that only the more evident faults were observed and that coal mining in the area will reveal many more" (Bass, Eby, and Campbell 1956). The area most affected by these faults, as far as coal mining is concerned, is in Section 8, T.4N., R.86W., where displacement is greatest and where there are either two faults creating a graben, or more than two faults and cross-fractures, with a consequent complex fracturing of coal and other rocks.

The Energy 3 mine area lies mostly on the southwest flank of a small structure known as the Curtis anticline, northeast of the Twentymile Park syncline. Dip of beds averages about 13° southwest, but a dip as high as 20° was noted on the north slope of the hill occupied by the present mine site. A normal fault, with the northeast side downdropped, trends northwesterly from near the southeast to the northwest corner of Section 36, T.6N., R.86W. Structure contours of Bass, Eby, and Campbell (1956) indicate vertical displacement on this fault may be about 100 feet further northwest in Section 26.

Geomorphology

Landscape character in and near the Energy mine sites results mostly from moderate folding of strata followed by differential erosion of interbedded hard and soft layers of various thicknesses.

Two large asymetrical cuestas are formed on the Iles and Williams Fork Formations in Energy 1 and 2 areas. The Trout Creek Sandstone Member forms a steep to vertical and partly overhanging cliff on the southeast-facing escarpment of the cuesta on which Energy 1 mine is located (Figure EII-2). The Twentymile Sandstone Member, also forming a steep to vertical and partly overhanging cliff, is the most conspicuous part of the escarpment of the cuesta between Energy 1 and 2 mines. The gentle northwest slopes of these cuestas are almost dip slopes, so that a given bed, for example the mined Wadge bed of the Energy 1 mine, or Fish Creek coal bed of Energy 2 mine, is at nearly the same depth near the top as well as farther down the slope, but does gradually increase in depth downslope. Southwesterly along the gentle slope of Energy 1 area land surface is undulating, partly because of small fault scarps.

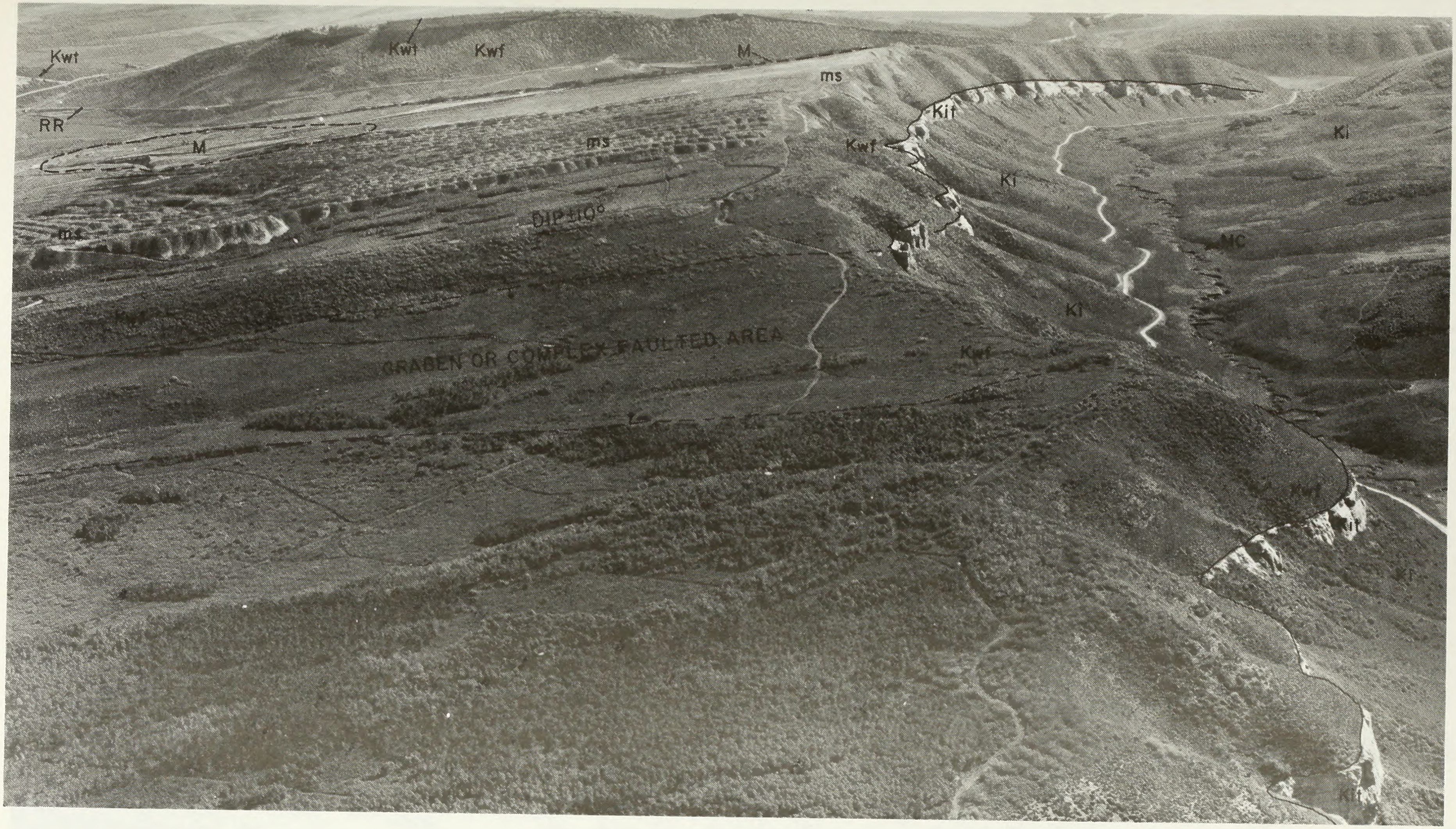


FIGURE EII-2

Aerial oblique photograph looking east at Energy 1 mine area (Ki, Iles Formation; Kit, Trout Creek Sandstone Member; Kwf, Williams Fork Formation; Kwt, Twentymile Sandstone Member; M, active mining area; ms, mine spoil piles and RR, railroad).

An unpublished photogeology interpretation map by Roger B. Colton, USGS, shows possible landslide or slump areas on Energy 1 slope, particularly in Sections 8 and 18, T.4N., R.86W. These probably are mostly or entirely soil creep landforms and/or small composite landslides; they may result from water saturation of areas where bedrock is broken up by faults and fractures. This same map shows possible landslides in Energy 2 area also, around and mostly north of the common corner of Sections 19 and 30, T.5N., R.86W., and Sections 24 and 25, T.5N., R.87W.; the uppermost beds of Williams Fork Formation are at the surface here.

Gentle slopes of cuestas are drained by small intermittent streams to Foidel and Fish Creeks. The valley of Middle Creek, and to a lesser severe degree that of Foidel Creek, are confined between a high escarpment northwest and more gentle slopes southeast. In the Energy 2 area Fish Creek meanders both intricately and broadly in a more open and gentle valley on the uppermost part of the Williams Fork Formation and overlying soft Lewis Shale (Figure EII-3).

The Energy 3 mine occupies a much smaller cuesta than that of Energy 1. The Energy 3 extension to the southeast (S 1/2 Section 1 and NE 1/4 Section 12) occupies a similar cuesta separated from Energy 3 by a small intermittent tributary to Fish Creek. Foidel Creek borders the latter cuesta on the southeast (Figure EII-4). In the NE 1/4 SE 1/4 Section 2 spoil from the Energy 3 mine has been dumped adjacent to Fish Creek, forcing this stream northward. Where the stream swings back to its original course beyond the spoil dumps (SW 1/4 NW 1/4 Section 1), one-foot-wide chunks of low grass-covered alluvial terrace were actively slumping into

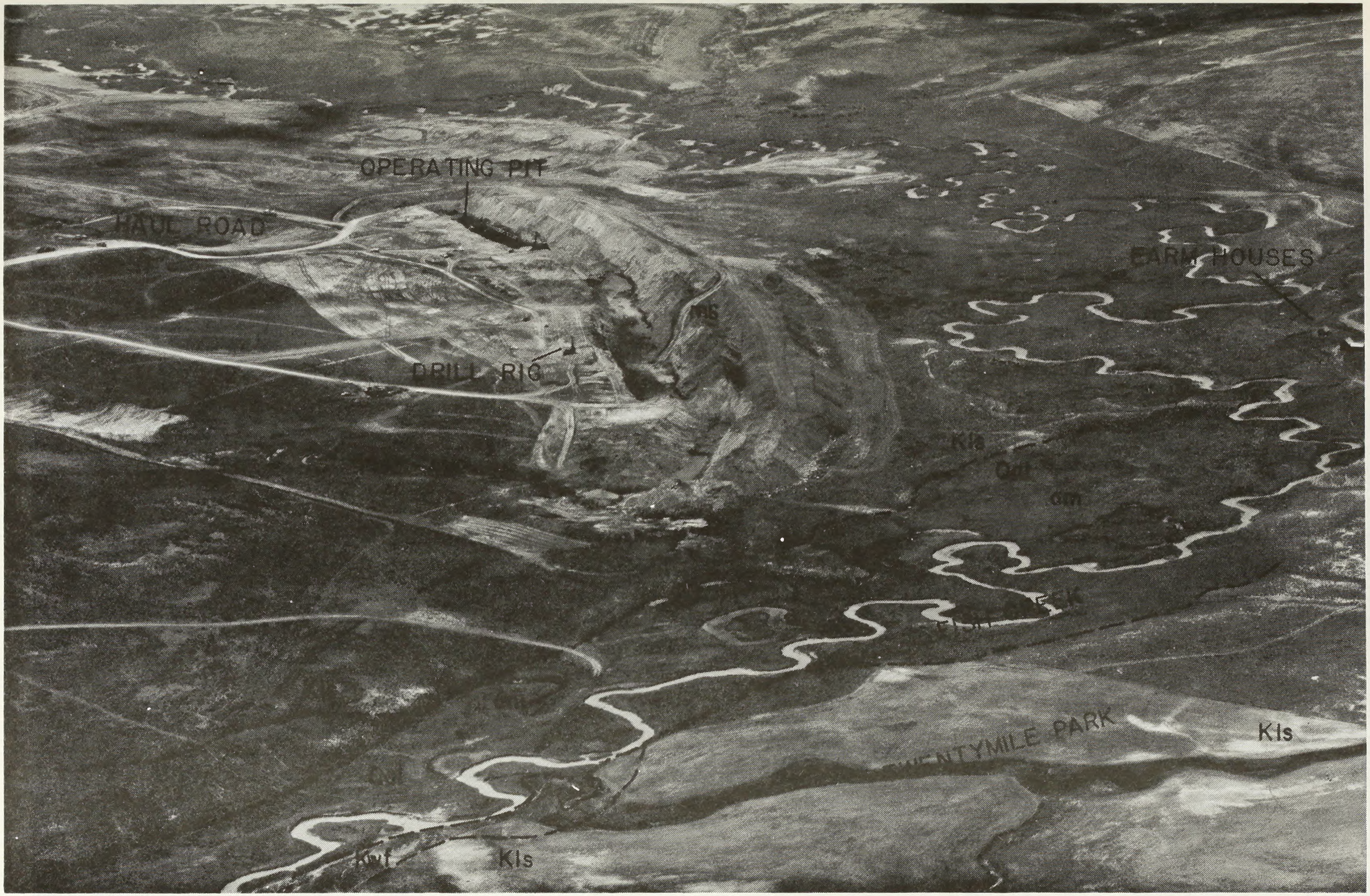


FIGURE EII-3

Aerial oblique photograph, looking southwest, of the Energy 2 Mine area (Kwf, Williams Fork Formation; Kls, Lewis Shale; Qal, alluvium; am, abandoned meander; ms, mine spoil pile).

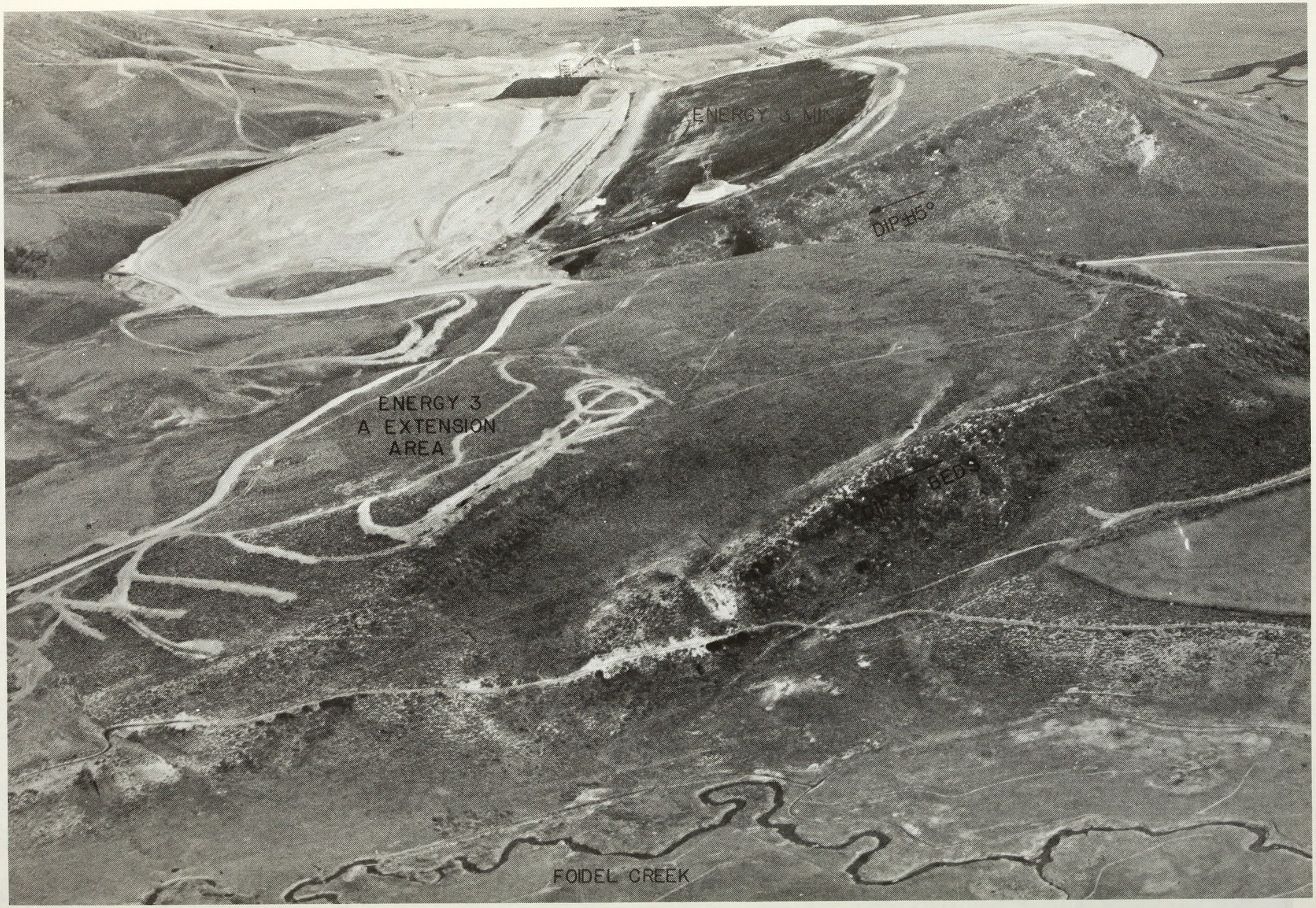


FIGURE EII-4

Aerial oblique photograph looking northeast at Energy 3 and 3A extension areas.

the stream (June 1975). Roughly 60 feet from the stream and above this slump area is a large concave part of the hill that resembles a landslide scar; if so, the landslide material was carried away by the stream long ago.

Further southeast, Middle Creek in SE 1/4 SE 1/4 Section 1 and NE 1/4 Section 12, T.5N., R.86W., and Trout Creek in SW 1/4 Section 6 and NW 1/4 Section 7, T.5N., R.85W., form a relatively wide valley before joining in SW 1/4 Section 6. Trout Creek is a meandering stream except for long and relatively straight reaches in most of NW 1/4 Section 7 and part of NW 1/4 Section 6, T.5N., R.85W. A small hillock of late Tertiary basalt in SE 1/4 NW 1/4 Section 7 forms a resistant body that has retarded erosion and forced Trout Creek to swing westward in a broad curve toward Middle Creek. This basalt hillock is on the lower westward-facing slopes of a dissected, northwest-sloping, low to moderately high tableland that is formed mostly on Browns Park Formation of late Tertiary age.

North, northwest, and west of the Energy 3, strata of the Iles and Williams Fork Formations form northwest-trending ridge lines separated by valleys that contain intermittent tributaries to Fish Creek. Ridge lines are maintained by resistant beds of these formations, two of them by the Trout Creek and Twentymile Sandstone Members. Fish Creek is an intricately meandering stream in Sections 1, 2, and 3, T.5N., R.86W. Some oxbow lakes have formed in cut-off meanders on the wide flat valley floor, north and northwest of Energy 3.

Paleontology

The coal-bearing formations in or near the proposed mining areas are the Iles and Williams Fork Formations. These are overlain in places by the Lewis shale (see Geologic Map, Appendix A).

Several types of fossils are known to occur in these formations: amonites and other marine fossils occur in the Lewis shale, and both the Williams Fork and Iles Formations contain fossil leaves, ammonites and inoseramus clams (within interbedded shales). No specific surface exposures of fossils have been reported on the lease areas.

Mineral Resources

Except for coal, no important mineral deposits are known or believed to occur on the Energy mine sites. The Energy 1 mine is about four miles northwest of the Oak Creek oil field; this oil field is higher on the Trout Creek anticline than is the Energy 1 site. Structure does not appear favorable for oil or gas accumulation beneath any of the three Energy Fuels' mine sites. There could be oil or gas entrapment by stratigraphic control, but a large amount of drilling in surrounding areas would be necessary to pinpoint such deposits on any of these sites.

Coal

The mined coal bed in Energy 1 and 3 mines is the Wadge bed of the middle coal group of the Williams Fork Formation (Figure EII-1). The mined bed in Energy 2 mine is the Fish Creek bed of the upper coal group. Other coal beds in the Williams Fork Formation that locally may be of sufficient quality, quantity, and availability for mining are the Wolf Creek and Lennox beds. In the Energy Fuels Corporation's 1974-1980 mine plan submitted to the USGS in November, 1974, these coal beds were described as follows:

> The Wolf Creek seam is a dirty coal being contaminated with thin layers of shale and bony material within the seam. A typical analysis on a "as received" basis would be about 10,000 btu's.
>
> Its thickness varies greatly and it has a tendency to form individual benches separated by shale seams. A measured section of 12' of Wolf Creek coal (USGS Bulletin 1027D) is reported in an old mine in the NW 1/4 Section 10, T.4N., R.86W., which is within one-third mile of the Energy 1 mine area yet this bed is quite thin or absent below the floor of the pit. Several miles to the north on privately owned coal it forms two benches of coal with a total thickness of 7' to 10' with about 3' separation between the seams.

The Wolf Creek bed is not being considered for mining on Energy's federal leases at this time and this is because of its erratic nature, low btu content and absence of favorable dip slopes above the bed.

The Wadge seam lies approximately 150' to 160' above the Wolf Creek seam and is the principal coal bed mined. In the Energy 1 pit the coal averages 6 1/2' to 7 1/2' thick and this increases to around 10' to the southwest. The coal dips to the northwest about 10 degrees into the Twentymile synclinal structure. Mine run coal from the Wadge seam averages about 11,200 btu's on a "as received" basis.

Roof condition overlying the Wadge seam is very stable and is several feet of hard shaley siltstone. The floor is a solid sandstone which provides a good footing for equipment mining the coal. The Wadge coal seam will account for approximately 90% of the coal mined on Energy's existing federal leases in the future.

The Lennox coal seam is positioned approximately 52' above the Wadge and appears embedded in a shale bed. The coal ranges up to 4' thick but is usually only 2 1/2' to 3 ' thick and is lenticular. The high sulphur content, 2% - 3%, prohibits its use as steam coal; however future sales may be realized if it is sized for use in stoker furnaces. Its btu content is just under 12,000.

The second most important coal bed is the Fish Creek seam and it lies near the top of the upper unit of the Williams Fork formation just below its contact with the overlying Lewis shale formation. The Fish Creek seam is considered to be in the upper coal group of the Mesaverde, and locally is 4 1/2' to 5' thick with sandstone roof and floor conditions. The btu content of this coal bed is comparable to the Wadge seam, and is positioned approximately 1052' above it in Energy 2 pit in Section 25, T.5N., R.87W.

The Wolf Creek coal bed could conceivably reach minable thickness in the Energy 1 and 2 mine areas, but would be below stripping depth except perhaps in small parts southwest of the present Energy 1 mine.

Quality of the coal, as indicated by analyses of coal in and near the Energy Fuel Corporation mines area, are shown in Table EII-2. The quality

TABLE EII-2

Analysis of Coal Samples from Localities near Energy Fuels Corporation Mines

(Made at the Pittsburg laboratory of the U.S. Bureau of Mines. Form of analysis: A, as received; B, air dried; C, moisture free; D, moisture and ash free)

Mine and location	No. on map	Location in mine	Coal bed and group	Formation	Lab. no	Air-drying loss	Form of analysis	Proximate				Ultimate					Heating value	
								Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Calories	Btu
Middle Creek mine of Frank Gould, NW¼ sec. 10, T. 4 N., R. 86 W.	46	Face of main entry, 390 ft from portal.	Wolf Creek, upper bench, middle coal group.	Williams Fork	C58119	2.7	A	7.7	40.9	45.3	6.1	.6	5.7	67.4	1.5	18.7	-----	11,940
							B	5.2	42.0	46.5	6.3	.6	5.5	69.3	1.5	16.8	-----	12,270
							C	----	44.3	49.0	6.7	.6	5.2	73.1	1.6	12.8	-----	12,940
							D	----	47.5	52.5	----	.7	5.6	78.3	1.7	13.7	-----	13,860
Do	46	do	Wolf Creek, lower bench, middle coal group.	do	C58120	2.5	A	7.8	39.4	43.9	8.9	.4	5.5	64.5	1.3	19.4	-----	11,440
							B	5.4	40.4	45.0	9.2	.4	5.4	66.2	1.4	17.4	-----	11,730
							C	----	42.7	47.6	9.7	.4	5.1	70.0	1.5	13.3	-----	12,400
							D	----	47.3	52.7	-----	.5	5.6	77.5	1.6	14.8	-----	13,740
Apex mine, SW¼ sec. 22, T. 4 N., R. 86 W.	52	600 ft north, 150 ft west of portal; 25 ft in by room no. 6.	No. 2?, lower coal group.	Iles	B34464	3.5	A	7.7	36.4	50.1	5.8	.6	5.7	68.7	1.5	17.7	-----	12,150
							B	4.4	37.7	51.9	6.0	.6	5.5	71.2	1.6	15.1	-----	12,590
							C	----	39.4	54.4	6.2	.7	5.2	74.4	1.6	11.9	-----	13,160
							D	----	42.0	58.0	-----	.7	5.5	79.4	1.7	12.7	-----	14,040
Greenhalgh prospect, face of drift 54 ft from portal, NE¼ sec. 32, T. 5 N., R. 86 W.	99a	Strip mine	Wadge	Williams Fork	C73282	5.6	A	10.1	35.7	48.4	5.8	.5	----	-----	----	-----	-----	11,670
							B	4.7	37.9	51.3	6.1	.5	----	-----	----	-----	-----	12,360
							C	----	39.7	53.9	6.4	.5	----	-----	----	-----	-----	12,970
							D	----	42.5	57.5	-----	.5	----	-----	----	-----	-----	13,860
Greenhalgh shaft, NE¼ sec. 32, T. 5 N., R. 86 W.	99b		do	do	E74290	5.0	A	11.1	35.0	47.5	6.4	.5	----	-----	----	-----	-----	11,380
							B	6.4	36.8	50.1	6.7	.5	----	-----	----	-----	-----	11,980
							C	----	39.4	53.5	7.1	.6	----	-----	----	-----	-----	12,800
							D	----	42.4	57.6	-----	.6	----	-----	----	-----	-----	13,790
Hutchinson mine, 6 miles southeast of Milner, SE¼ sec. 12, T. 5 N., R. 86 W.	89	10 ft from surface	Wadge, middle coal group.	do	1832	6.2	A	12.5	35.2	46.9	5.4	.42	5.83	63.25	1.43	23.63	6,135	11,050
							B	6.7	37.5	50.0	5.8	.45	5.48	67.43	1.52	19.32	6,545	11,780
							C	----	40.2	53.6	6.2	.48	5.07	72.29	1.63	14.31	7,015	12,630
							D	----	42.8	57.2	-----	.51	5.41	77.08	1.74	15.26	7,480	13,460
Hutchinson mine of Tom Chergo, 6 miles southeast of Milner, NW¼NE¼ sec. 13, T. 5 N., R. 86 W.	90		do	do	31038	4.0	A	12.8	37.2	44.4	5.6	.43	5.77	63.26	1.49	23.46	6,130	11,030
							B	9.2	38.7	46.3	5.8	.45	5.54	65.90	1.55	20.74	6,386	11,500
							C	----	42.6	51.0	6.4	.49	4.99	72.57	1.71	13.83	7,030	12,660
							D	----	45.5	54.5	-----	.52	5.33	77.54	1.83	14.78	7,515	13,530
Arthur mine (later known as Edna) of John Arthur, SW¼ sec. 24, T. 4 N., R. 86 W.	57	Face of left entry, 425 ft from mouth.	Wadge, middle coal group.	do	A34345	2.7	A	10.1	38.4	43.5	8.0	.6	5.9	63.0	1.4	21.1	6,228	11,210
							B	7.5	39.5	44.8	8.2	.7	5.7	64.7	1.5	19.2	6,400	11,520
							C	----	42.7	48.4	8.9	.7	5.3	70.0	1.6	13.5	6,922	12,460
							D	----	46.9	53.1	-----	.8	5.8	76.8	1.8	14.8	7,600	13,680
Johnnie's mine, NE¼ sec. 33, T. 4 N., R. 86 W.	68	Tipple sample (5 tons)	Lower coal group.	Iles	C78023	1.4	A	8.4	39.0	48.8	3.8	.5	5.8	70.1	1.5	18.3	-----	12,360
							B	7.1	39.6	49.5	3.8	.5	5.8	71.1	1.5	17.3	-----	12,540
							C	----	42.5	53.4	4.1	.5	5.4	76.5	1.7	11.8	-----	13,490
							D	----	44.4	55.6	-----	.5	5.6	79.8	1.7	12.4	-----	14,070

SOURCE: USGS Bulletin 1027-D

of the coal has been described by Bass, Eby, and Campbell (1955) as follows:

> All of the coal is noncoking. As was pointed out by Campbell (1923, p.68), the coal of the Iles and Williams Fork formations of this region is hard and shiny, breaks in large lumps and blocks when mined, withstands transportation to distant markets, and is clean to handle. Coal of the lower and middle groups is of bituminous rank. Coal of the upper group contains slightly more moisture and less volatile matter and has a lower heating value than coal of the middle and lower groups; it is on the margin between sub-bituminous and bituminous rank, but is here classed as sub-bituminous.

There are no detailed estimates of the reserves of coal on Energy Fuels Corporation's Federal coal leases. A report for the company, (April 30, 1975) reports on the reserves as follows:

> A detailed analysis of overburden depths, coal quality, eroded coal seams, and burnt areas has not been completed due to the lack of drilling information; however, a preliminary reserve estimate of coal occurring on lease areas 1, 2, and 3 in the Wadge and Fish Creek seams could approach 20-million tons maximum, assuming no coal voids and 90-percent mining extraction.

Calculations based on some drilling information of the company and its predecessors, and on scanty outcrop information, produced the following rough estimates of coal reserves of these two beds on parts of the company's Federal coal leases. These estimates assume the average figure of 1,800 tons/acre-foot of coal generally used for bituminous coal (Landis 1959). The figures derived agree reasonably well with the 20 million ton figure (Table EII-3). An additional reserve occurs on the company's privately owned lands.

The company is mining privately owned coal at Energy 3 mine area and holds no Federal leases there. It has requested competitive leasing in

Sections 2 and 3, T.5N., and Sections 34 and 35, T.6N., R.86W. Estimates of coal reserves in these areas would require detailed geologic field work and extensive drilling.

TABLE EII-3

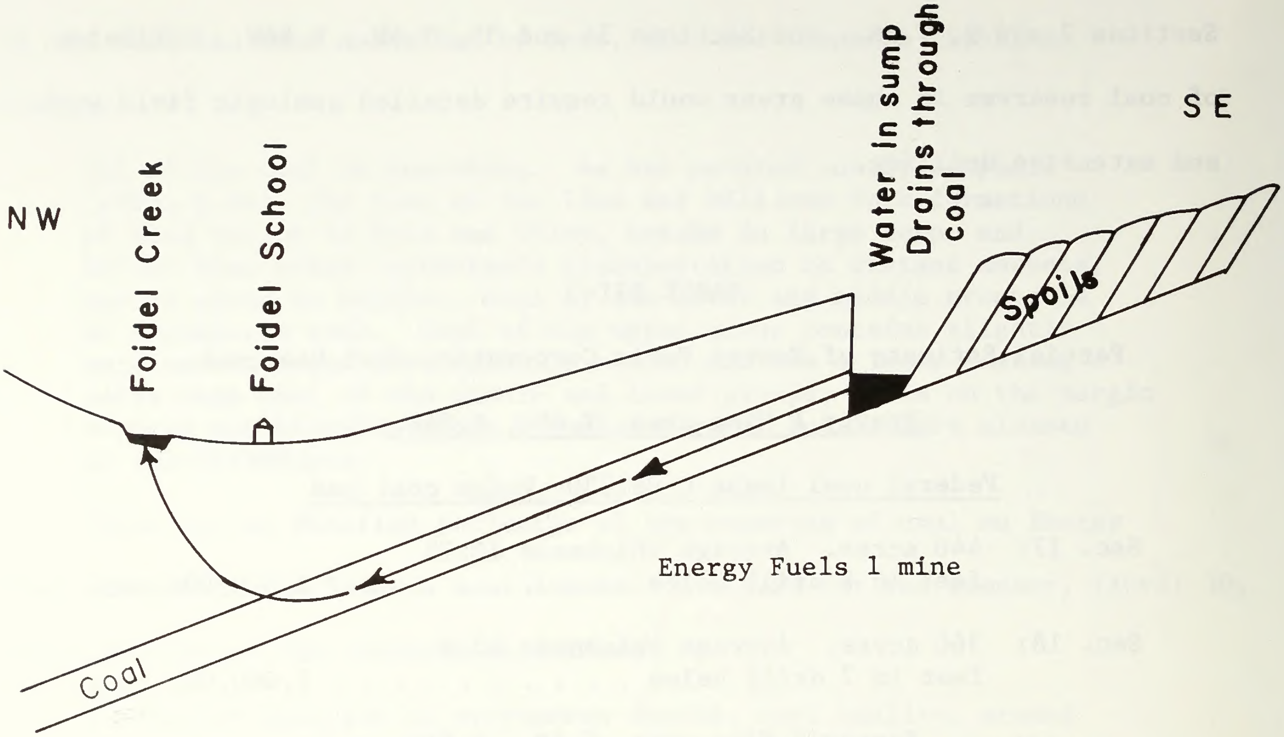
Partial Estimate of Energy Fuels Corporation Coal Reserves

Energy 1 Mine area. T.4N., R.86W.		
Federal coal lease C-081330. Wadge coal bed		
Sec. 17:	440 acres. Average thickness 10.75 feet in 8 drill holes	8,510,000 tons
Sec. 18:	360 acres. Average thickness 10.9 feet in 7 drill holes	7,060,000 tons
Energy 2 Mine area. T.5N., R.86W.		
Federal coal lease C-081330. Fish Creek coal bed		
Sec. 20:	240 acres. Average thickness 4 feet by company estimate.	1,730,000
Sec. 21:	160 acres. Average thickness 4 feet by company estimate.	1,150,000
	Total	18,450,000 tons

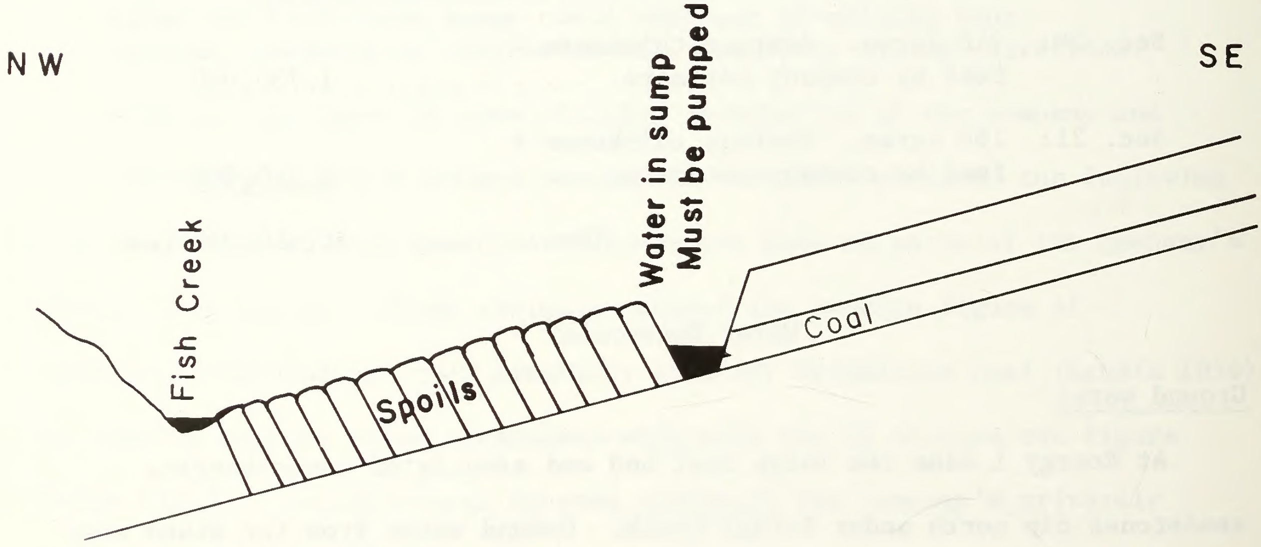
Water Resources

Ground water

At Energy 1 mine the Wadge coal bed and associated water-bearing sandstones dip north under Foidel Creek. Ground water from the mined area is discharged by upward leakage from the coal and associated sandstones to Foidel Creek, and to an area of barren alkali-covered ground and water-loving grasses along Foidel Creek in the NW 1/4 SE 1/4 Section 29,



Energy Fuels 1 mine



Energy Fuels 2 mine

FIGURE EII-5

Hydrologic conditions at the Energy Fuels 1 and 2 mines.

T.5N., R.86W. On June 12, 1975 when measurements were made by USGS, discharge into Foidel Creek was about one-quarter-second foot or a little over 100 gallons/minute (gpm); discharge from the vegetation and evaporation from the ground surface would increase this figure. Water stands in the lower end of the Energy 1 mine pit about 3,000 feet south and 100 feet higher than Foidel Creek. Although the water in the mine pit accumulates from both surface and ground water runoff from an area of about one square mile, the pit does not fill up nor need to be pumped; it is assumed that the water drains from the pit by natural discharge via the aforementioned path (Figure EII-5). Dissolved solids in Foidel Creek approximately doubled as the result of upward leakage into the stream. Water of similar quality and concentration to that in the mine pit would cause this change if it were discharged to the stream in the amounts that were measured. Analysis of these waters are given in Table EII-3a.

The ground water discharge into and along Foidel Creek appears to be natural; however there has probably been an increase in amount of discharge, and water quality has probably deteriorated as the result of mining operations. Currently, where the ground water is near the surface north of the Foidel school, salts have accumulated on the surface; a pre-mining photograph of this area does not show any salt accumulation. Chemical quality of water in Foidel Creek is not likely to be detrimental to aquatic life even during low flow conditions in late summer when upward leakage from the coal would not be diluted as much by flow of better quality water from upstream. Diversity index for aquatic insects was much the same above and below the area of discharge of poor quality water; it was low in both places probably as the result of sediment pollution resulting from road

TABLE EII-3a

Dissolved Solids in Selected Wells, Streams, and Mine Pits

	Consolidation Fuels Test Holes		Energy 1 Pit	Foidel Creek Near Tipple	Foidel Creek Near Foidel School	Energy 2 Pit	Monitor Well P-2	Seneca 2 Pit	Seneca 2 Shop Well
	1	2	3	4	5	6	7	8	9
Calcium mg/l	37	34	410	71	140	75	64	250	200
Magnesium mg/l	21	21	180	35	71	29	77	170	77
Potassium mg/l	13	3	6	3	3	3	4	10	4
Sodium mg/l	200	190	64	19	36	44	76	160	31
Bicarbonate mg/l	710	583	217	313	305	314	518	416	557
Chloride mg/l	4	3	7	4	6	7	4	18	21
Fluoride mg/l	0.8	1.3	0.3	0.3	0.3	0.3	0.1	0.4	0.3
Sulfate mg/l	39	120	1,500	84	430	80	220	1,300	420
NO_2 + NO_3 as ND mg/l	0.01	0.02	18	0.05	1.4	13	0.00	5.0	0.07
Silica mg/l	9.6	16	5.4	8.8	5.3	11	14	5.8	14
TDS mg/l	677	676	2,360	380	848	462	720	2,140	1,050
Arsenic μg/l	0	0	0	2	1	0	0	0	0
Cadmium μg/l	0	0	1	0	0	1	0	1	4
Cobalt μg/l	0	0	0	0	0	1	0	0	0
Copper μg/l	0	0	3	3	4	5	0	0	250*
Iron μg/l	2,200	390	40	110	90	60	2,000	50	90
Lead μg/l	0	1	0	0	0	0	0	1	0
Manganese μg/l	80	0	20	70	110	80	50	70	17
Mercury μg/l	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0
Molybdenum μg/l	0	0	1	0	0	3	0	1	0
Nickel μg/l	2	0	9	4	2	3	1	14	0
Selenium μg/l	0	0	47*	0	3	0	0	5	4
Vanadium μg/l	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Zinc μg/l	8	10	20	10	8	4	2,200*	30	20
Conductivity	1,090	1,080	2,850	600	1,200	740	1,500	2,420	1,450
pH	7.7	7.6	7.6	7.8	8.1	7.8	6.9	7.5	7.5
SAR	6.5	6.3	0.7	0.5	0.6	1.1	1.5	1.9	0.5
Water Temperature	14.5	18.0	18.5	23.0	22.0	25.0	10.0	16.0	20.5

* Excessive value (probably due to contamination of sample).

Samples collected and analyzed by USGS, 1975 (unpublished) construction. Chemical quality of the water could conceivably cause a deterioration in yields from irrigated crops; however this cannot be quantified and is not likely to be significant.

Energy 2 mine is operated so the spoils are placed downslope from the actively mined part of the area. As a result the lowest part of the mine where the drainage from the ground water accumulates, is upslope from the part of the mine that has been refilled with spoils (Figure EII-5). The water in this sump accumulates at a rate that requires pumping. This is done periodically, but in spring it appears to average about 100 gpm, roughly the same as is discharged naturally from Energy 1 mine. Energy 2 mine closely parallels Fish Creek, and it may be that before mining operations started, water from coal and associated sandstones discharged by upward leakage into this stream. However spoils appear to be less permeable than unmined ground, and hence may serve as a dam to prevent movement of ground water to the stream. At Energy 1 mine there are no spoils between the lower end of the mine and the stream.

The chemical quality of the water from Energy 2 mine is similar to that from Energy 1 mine, except that Energy 1 is higher in sulphate and TDS. However the discharge of water from Energy 2 mine into Fish Creek will have no discernable effect on water quality in the stream. The amount of water pumped from the mine diminishes during the summer until there is only enough to use for sprinkling the haul roads; there is no discharge into Fish Creek during periods of low flow.

Surface water

Drainage and stream flow characteristics

Existing and proposed mining areas of Energy Fuels Corporation lie in the Trout Creek drainage system which heads in the panhandle area of Rio

Blanco County, and flows generally north through the south-central part of Routt County to its confluence with Yampa River near the town of Milner. Major tributaries of Trout Creek involved in the mining area are Middle Creek and Fish Creek. Foidel Creek, a tributary of Middle Creek, is also affected by existing and proposed mining operations. Figures EI-3 and 4 show the overall drainage system of Trout Creek and its tributaries. The following listing indicates the basic drainage system and tributary ranking of these major streams:

- Yampa River
  - Trout Creek
    - Middle Creek
      - Foidel Creek
    - Fish Creek

Fish and Trout Creeks are perennial streams, i.e., streams which generally flow continuously, especially during periods of low flow when flow is sustained by ground water recharge. Foidel and Middle Creeks are considered to be intermittent according to USGS topographic maps of the area. Intermittent streams generally run only from snowmelt or intense local rainfall-runoff; there is usually insufficient ground water to maintain flow during periods of little or no precipitation. All streams of the drainage system have small, intermittent tributaries.

Headwaters of Trout Creek are located on Mount Orno south of the mining area at an elevation of approximately 12,000 feet. Thus Trout Creek derives most of its runoff from snowmelt in June and July (see Figure EII-6 for a typical hydrograph for this stream). The stream is not affected by mining until just above the mouth of Middle Creek, at which point Energy 3 mine lies on the east bank. Surface drainage from Energy 3

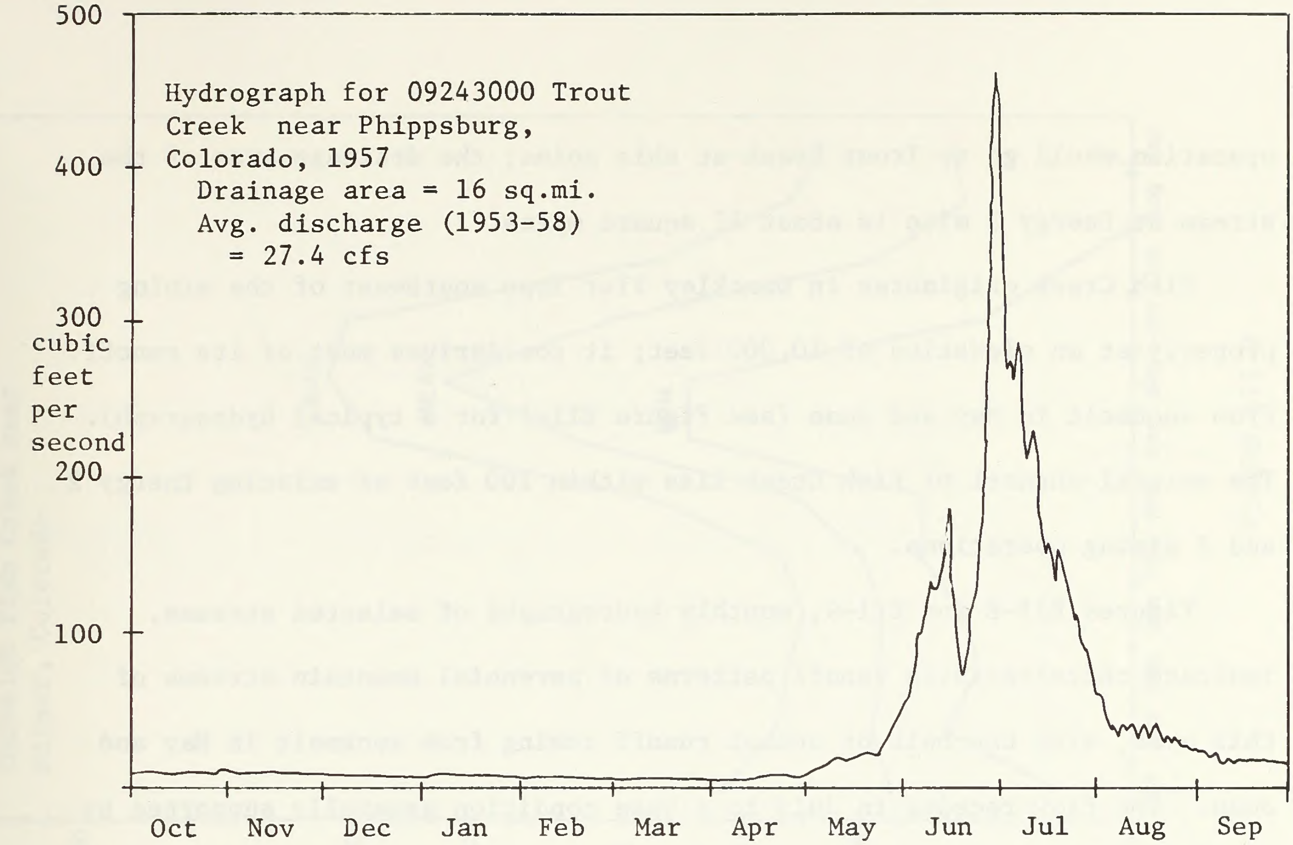


FIGURE EII-6

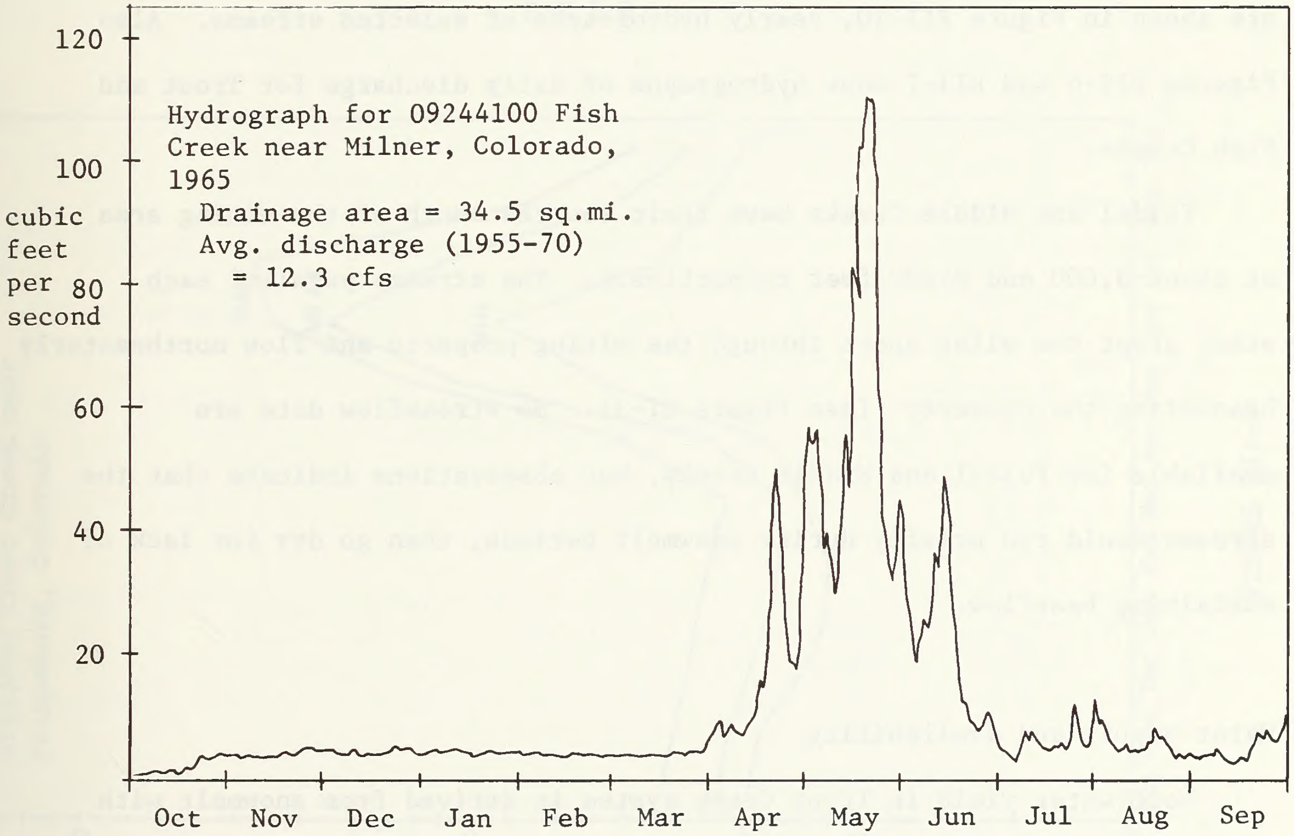


FIGURE EII-7

Typical daily hydrographs of selected streams.

operation would go to Trout Creek at this point; the drainage area of the stream at Energy 3 mine is about 52 square miles.

Fish Creek originates in Dunckley Flat Tops southwest of the mining property at an elevation of 10,000 feet; it too derives most of its runoff from snowmelt in May and June (see Figure EII-7 for a typical hydrograph). The natural channel of Fish Creek lies within 100 feet of existing Energy 2 and 3 mining operations.

Figures EII-8 and EII-9, monthly hydrographs of selected streams, indicate characteristic runoff patterns of perennial mountain streams of this area, with the bulk of annual runoff coming from snowmelt in May and June. The flow recedes in July to a base condition generally supported by ground water inflow from July to April. Variations in mean annual flows are shown in Figure EII-10, yearly hydrographs of selected streams. Also Figures EII-6 and EII-7 show hydrographs of daily discharge for Trout and Fish Creeks.

Foidel and Middle Creeks have their sources south of the mining area at about 8,000 and 8,600 feet respectively. The streams parallel each other about two miles apart through the mining property and flow northeasterly bracketing the property (see Figure EI-3). No streamflow data are available for Foidel and Middle Creeks, but observations indicate that the streams would run briefly during snowmelt periods, then go dry for lack of sustaining baseflow.

Water supply and availability

Most water yield in Trout Creek system is derived from snowmelt with about 55 percent coming in June and July. Trout and Fish Creeks contribute

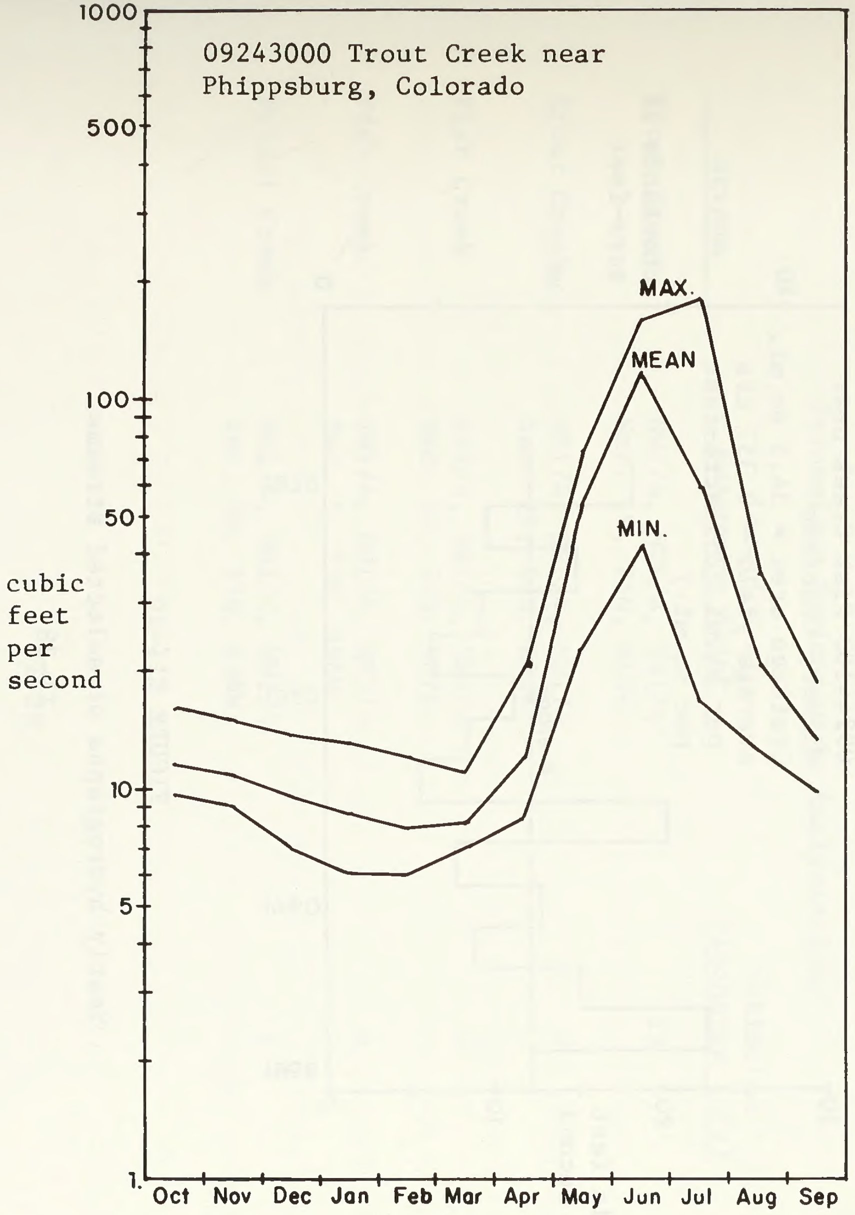


FIGURE EII-8

Monthly hydrographs of 09243000 Trout Creek near Phippsburg, Colorado.

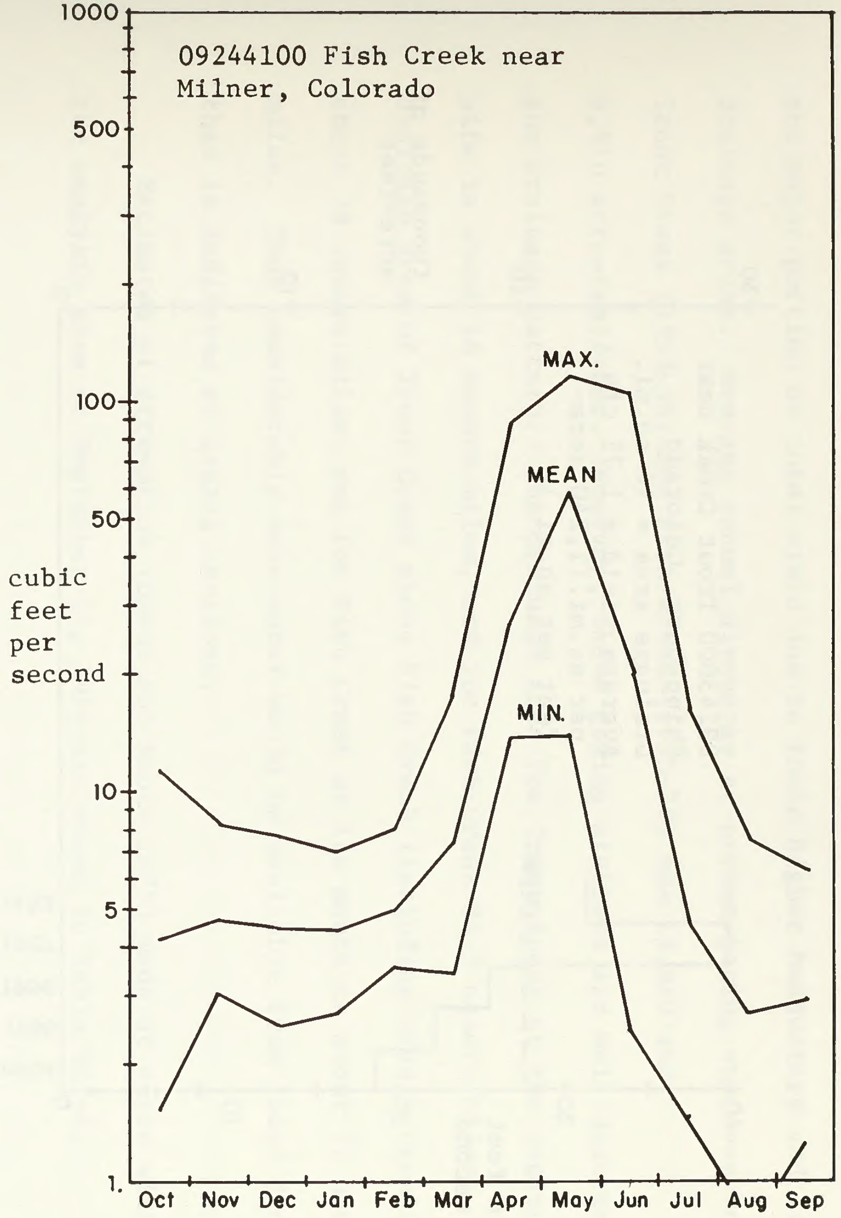


FIGURE EII-9

Monthly hydrographs of 09244100 Fish Creek near Milner, Colorado.

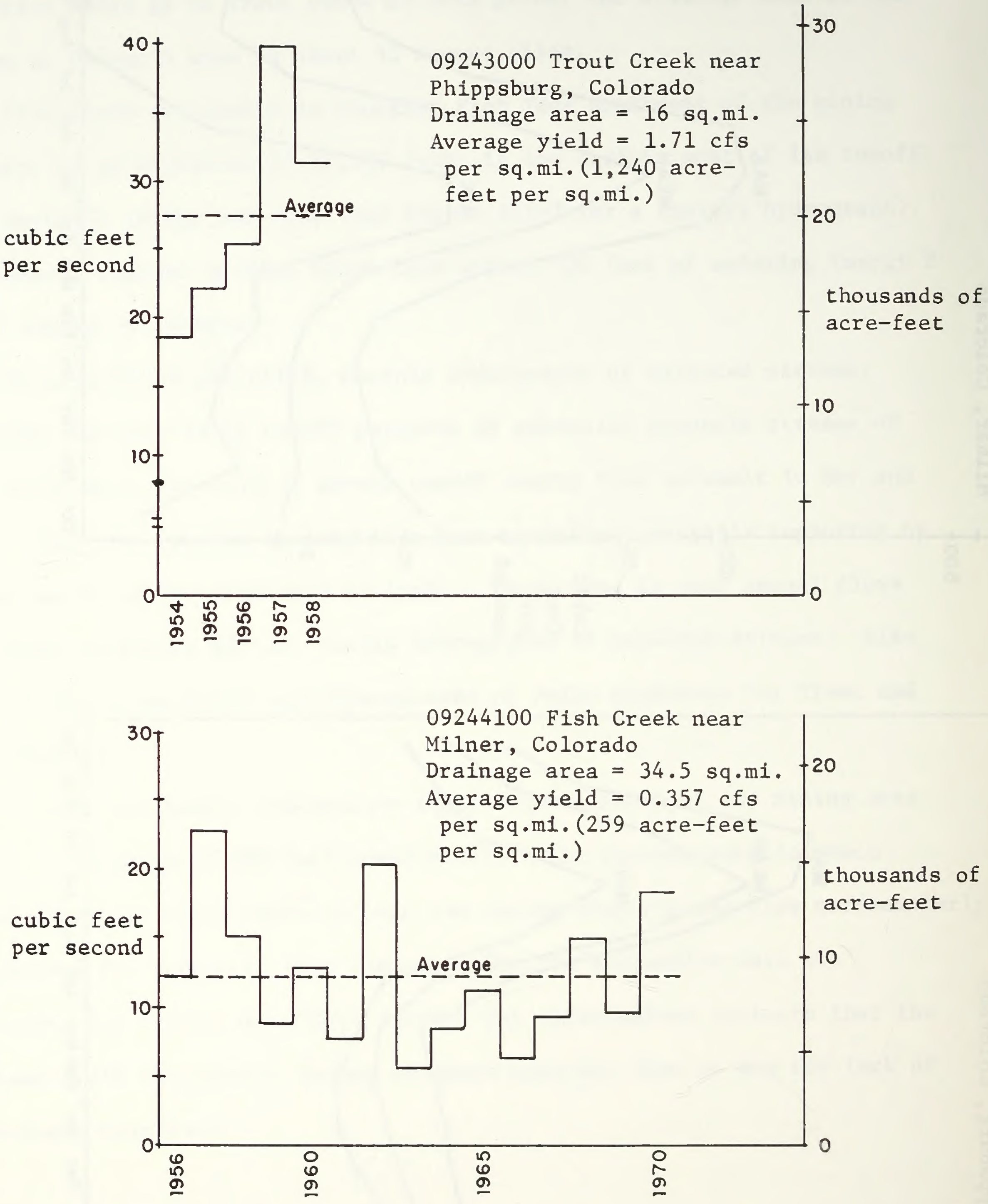


FIGURE EII-10

Yearly hydrographs of selected streams.

the major portion of total yield due to their higher headwaters and larger drainage areas. Average annual discharge at stream gaging stations on Trout Creek (1953-58) and Fish Creek (1955-70) was 19,840 and 8,910 acre-feet/year. However, these gaging stations are well upstream in the drainage pattern. The drainage area for Trout Creek at the gaging site is about 16 square miles, and for Fish Creek 34.5 square miles. The drainage area of Trout Creek above Fish Creek (including Middle Creek) is about 78 square miles, and for Fish Creek at its mouth is about 77 square miles. Thus considerably more water would be available from total drainage than is indicated at gaging stations.

Estimates of streamflow (Dames and Moore 1975) made at sites within the analysis area on September 11, 1974 are shown in Table EII-4.

TABLE EII-4

Streamflow Estimates in Analysis Area

Stream	Location of Measuring Point	Estimated Discharge (cfs)
Trout Creek	NW1/4, NW1/4, SW1/4 Sec. 19, T5N, R85W	13
Trout Creek	NE1/4, NE1/4, NW1/4 Sec. 25, T6N, R86W	9
Fish Creek	SW1/4, SW1/4, SW1/4 Sec. 25, T5N, R87W	2
Fish Creek	NW1/4, NW1/4, NW1/4 Sec. 1, T5N, R86W	4
Foidel Creek	NW1/4, NW1/4, NW1/4 Sec. 28, T5N, R86W	1

These estimates were made by timing rate of flow over a measured distance and estimating average depth and width of stream to determine its area. Streamflow measurements on June 19, 1975, on Foidel Creek at the county road crossing in the NW 1/4 SW 1/4 NW 1/4 Section 32, T.5N., R.86W., and below Foidel School in the NW 1/4 NE 1/4 SE 1/4 Section 29, T.5N., R.86W., show 0.88 and 1.13 cubic feet per second (cfs) respectively; the measurements were made by EIS team personnel.

Water utilization

Present commitment of water in Trout Creek system can be obtained from a computer listing of water rights (Stream Alpha Lists) for Yampa River Basin developed by the Colorado Division of Water Resources, State Engineer's Office in Denver.

In addition to existing uses of water, potential developments are indicated in the following listing, Colorado Water Conservation Board (CWCB 1969):

Name	Principal use of water released from storage	Capacity (acre-feet)
Dunckley Reservoir	Irrigation	56,900
Trout Creek Reservoir	Power	24,300
Twenty-Mile Reservoir	Irrigation	15,300

Primary water use in the analysis area is for irrigation of hayfields and livestock maintenance (Dames and Moore 1975). Irrigation of crops in the area is accomplished by utilizing small diversion ditches in fields lying in stream floodplains.

Municipal-domestic utilization of water is negligible in the analysis area. The few scattered family residences in the analysis area obtain their water supplies from private wells; there are no population centers which draw water from the Trout Creek watershed.

Energy Fuels Corporation obtains water for dust control from two sites in the analysis area - Foidel Creek near Foidel School in Section 29, T.5N., R.86W., and an impoundment of a tributary to Fish Creek in SE 1/4 SE 1/4, SE 1/4, Section 2, T.5N., R.86W. In addition Energy Fuels obtains water from a well near Foidel Creek directly north of Energy 1 mine in Section 32, T.5N., R.86W., for use in their office and shop. (Water quality for this well is described in the ground water section of this chapter.)

Quality of streams in the analysis area

There is very limited information on which to base an analysis of chemical water quality in Trout Creek watershed; there has not been any continuous water quality monitoring in the analysis area. The only information currently available consists of random grab samples (i.e., single samples taken on a particular date at a specific location and from which no trends can be developed) taken by a variety of interest groups. While the value of such information is dubious, a cursory overview of the local water quality may be afforded by the presentation of some of these data (see Tables EII-5, EII-6, and EII-7).

TABLE EII-5

Mean Water Quality Values for Trout Creek (Near Mouth at Milner)
from 5-65 to 5-66

Parameter	Reported Value	Unit
Specific Conductivity	330	umhos at 25° C
pH	7.5	
Bicarbonate (HCO_3)	143	mg/l
Residue on Evaporation (105°C)	193	mg/l
Total Hardness (as $CaCO_3$)	145	mg/l
Calcium	35	mg/l
Magnesium	14	mg/l
Sodium	8.6	mg/l
Potassium	1.8	mg/l
Chloride	1.7	mg/l
Sulfate	43	mg/l

Abbreviations Used: mg/l = milligrams per liter; umhos = micromhos;
°C = degrees Centigrade

SOURCE: Colorado Water Pollution Control Commission, 1974.

TABLE EII-6

Water Quality Values for the Yampa River at Milner
Above the Confluence of Trout Creek

Date	9-26-73	10-17-73	4-3-74	4-10-74
pH	-	-	8.40	8.30
D.O. (mg/l)	11.6	11.8	10.1	9.9
Turb. (JTU)	12.0	22.0	15.0	20.0
NO_3-N (mg/l)	0.20	0	0.35	0.35
Tot. PO_4 (mg/l)	0	0.10	-	-
Fecal Coli. (/100 ml)	-	-	220	2
BOD_5 (mg/l)	1.7	1.6	2.0	-
NH_3-N (mg/l)	0.04	0.08	0.08	0
Time of day	1,640	1,750	1,015	1,735
Water Temp (°F)	54.0	54.0	-	-
Magnesium - Total (mg/l)	8.0	10.0	5.0	13.0
Sodium - Total (mg/l)	15.0	14.0	13.0	13.0
Fluoride - Total (mg/l)	0.3	0.2	0.2	0.2
Arsenic - Total (mg/l)	0	0	0	0
Boron - Total (mg/l)	50	60	70	40
Cadmium - Total (mg/l)	0	0	0	0
Copper - Total (mg/l)	0	0	0	0
Lead - Total (mg/l)	0	0	0	0
Zinc - Total (mg/l)	0	0	0	0
Selenium - Total (mg/l)	0	0	0	0

Abbreviations used: Mg/l = Milligrams per liter
JTU = Jackson Turbidity Unit
Turb. = Turbidity
NO_3-N = Total Nitrates
Tot. PO_4 = Total Phosphates
Fecal Coli. = Fecal Coliform
Ml = Milliliter
BOD_5 = 5-day Biochemical Oxygen Demand
NH_3-N = Total Ammonia
°F = degrees Farenheit
D.O. = Dissolved Oxygen

SOURCE: Colorado Department of Health, 1975

TABLE EII-7

Water Quality at Selected Stream Sites in the Trout Creek Watershed

		Field Observations					Laboratory Determinations															
							Trace Elements, Micrograms per liter															
Station Name	Date	Turbidity	Flow Source	Temperature °C	pH	Specific Conductance, Micromhos per Centimeter at 25°C	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Maganese (Mn)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Vanadium (V)	Zinc (Zn)	Sulfate (SO_4) Milligrams per liter
Fish Creek at mouth on Trout Creek	06-09-72	ST	SM	15.5	7.4	560	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Middle Creek at mouth On Trout Creek	06-09-72	T	SM	15.0	7.2	550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trout Creek above Middle Creek	06-09-72	T	SM	10.0	7.9	145	1	0	-	0	1	130	2	0	.0	-	3	-	0	-	30	15
Yampa River at mouth of Trull Creek above Trout Creek effluent	10-15-71	-	-	6.5	7.7	750	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yampa River at mouth of Grassy Creek below Trout Creek effluent	06-07-72	T	-	20.5	7.7	1,100	0	0	-	0	0	20	1	810	0.0	-	6	-	0	-	10	300

Abbreviations Used: ST = Slightly Turbid; SM = Snow Melt; T = Turbid

SOURCE: Wentz 1974.

Streams in Trout Creek drainage are typical of most streams which receive the bulk of their water yield from snowmelt; their waters are essentially calcium bicarbonate with substantial amounts of sulfate present. These streams exhibit their greatest conductivity values during winter possibly due to the fact that ground water (which is typically high in salt content in the analysis area), and not surface water, is the main source of stream flow during this part of the year. Generally calcium is the dominant cation (i.e., positively charged ion) in the area's streams, although sodium and magnesium become more significant during periods of low flow.

The pH of streams in Trout Creek watershed are basic varying from 7.4-8.4, indicating a high concentration of bicarbonate (HCO_3-) ions. Other anions (i.e., negatively charged ions) which may be expected to be of significance in the local watershed, are sulfate (SO_4-) and to a lesser extent, chloride (Cl-). Bicarbonate appears to increase proportionately during high runoff periods, while sulfates are significant in early spring, but are less prevalent during other periods of the year.

Turbidity could be expected to increase during spring runoff as increasing stream flow is correlated to increasing sediment load. Overall turbidity values ranged from 4-40 Jackson Turbidity Units (JTUs) and are considered low.

Stream quality factors that significantly affect or are affected by biological processes are nitrates, phosphates, dissolved oxygen, coliforms and biochemical oxygen demand (BOD). Nitrate and phosphate concentrations appear to be relatively small throughout the watershed and fluctuate markedly. During spring months when snowmelt begins to feed the streams in the area, the runoff is rich in nitrogen and probably phosphate as it drains areas where cattle and sheep have been feeding during the winter.

Streams in the Trout Creek drainage area are classified B_1 by the Colorado Department of Health (1974). This classification means local streams are suitable for all purposes for which raw water is customarily used, except primary contact recreation, such as swimming and water skiing. In addition the water in Class B_1 streams has: (1) a geometric mean of less than 10,000 total coliform groups or 1,000 fecal coliform groups per 100 milliter/sample, (2) a dissolved oxygen content of at least six milligrams/liter (mg/l), (3) a pH rating of no more than 9.0 nor less than 6.0 units, (4) a temperature which maintains a normal pattern of diurnal and seasonal fluctuations, and is not increased above 20°C (68°F) by any other than natural means, and (5) no increases in turbidity of over ten (JTUs) during any single period (Colorado Department of Health 1974). As shown in Table EII-5, the highest fecal coliform value recorded for the analysis area was 220 (probably bacterial) groups/100 milliliters. The 5-day BOD ranged from 1.5-2.0 for the analysis area. These values are normal for a drainage area which is not subject to significant pollution. Water temperatures ranged from 6.5°C (44°F) to 20.5°C (69°F) on the various dates that streams in the analysis area were sampled (see Tables EII-5, EII-6, and EII-7).

Physical nature of streams

Physical quality of portions of streams of Trout Creek watershed in the vicinity of the existing Energy Fuels mining operations is poor.

Streams in this area are meandering and have flows of less than five cfs. In addition the sediment load carried by these streams appears to be relatively high throughout the year. The Colorado Division of Wildlife (DOW) (1972) rates streams in Trout Creek drainage as average or below average, regarding clarity of water and pool-riffle ratio. In addition annual water temperature regime of these streams is borderline for the cold-water species which exist there.

Physical quality of the streams in the mining area was examined by EIS personnel during a field inspection on June 12, 1975. Heavy sediment loading, low quality riparian (stream-bank) vegetation, and generally poor stream bottom conditions were noted during this investigation. Very few riffle areas (areas of shallow, fast-flowing water with rocky substrate - as opposed to pools) were observed, and existing riparian vegetation offered little cover to the stream-course.

Existing water-land-resource problems as related to existing mining activities

Several areas of surface water degradation resulting from ongoing Energy Fuels mining activities were noted during field inspections of the analysis area made by EIS team personnel during the first two weeks of June 1975. Overburden which was removed from Energy 3 mining area was dumped across Fish Creek as it flows northeast a few hundred yards from the mine (Figure EII-11). A channel was constructed by Energy Fuels and stream flow was diverted around the overburden pile via this ditch. The pile of overburden has not been reclaimed, and sediment load in Fish Creek

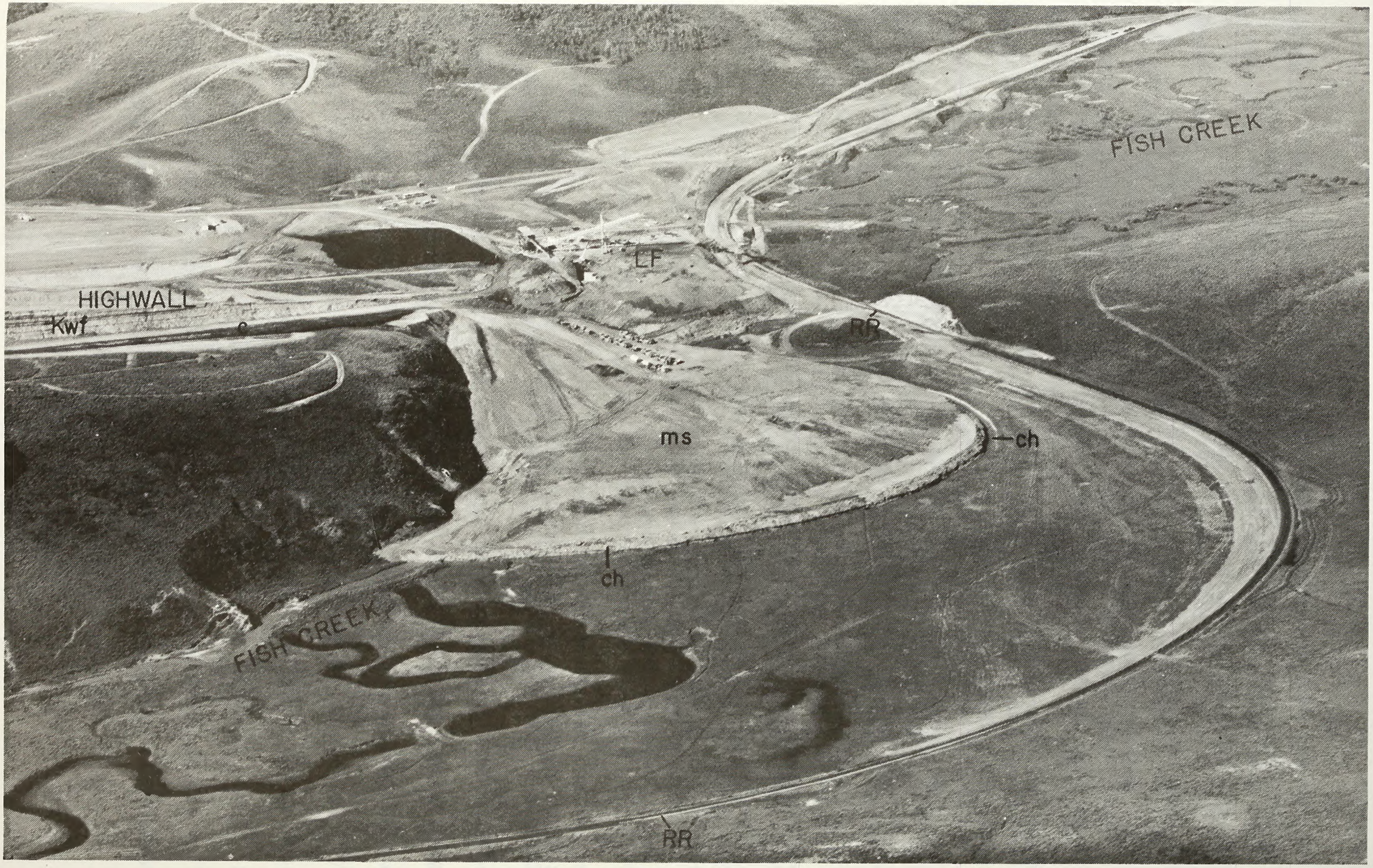


FIGURE EII-11

Rerouting of Fish Creek around mine spoils at Energy 3 mine (c, coal bed; ch, new stream channel; Kwf, Williams Fork Formation; LF, coal loading facilities; Lsc, old landslide scar; ms, mine spoils; ob, oxbow lakes and x, locality of sandstone dipping 20°)

increases as it flows in direct contact with the pile. An investigation of the downstream area (i.e., below the channelization project) indicated that much of the stream bottom has been silted in as a result of this operation. Some deterioration of the chemical stream quality due to dissolved solids leaching out of the overburden pile into the stream was also occurring.

Ground water encountered during operations at Energy 1 and 2 mines is accumulated in mining pits. Some of this water is utilized by Energy Fuels for dust control. Unutilized water at Energy 1, which is typically higher in TDS than local surface water, flows into Foidel Creek via natural underground runoff. Water in Foidel Creek below the influx of water from the mining pits was measured to be higher in TDS than water upstream from this influent.

Excess water at Energy 2 location has been pumped from pits and allowed to seek its own course over approximately 150 yards to Fish Creek. The area into which this water is pumped has been highly disturbed with earth-moving equipment, resulting in increased erosion as pit water flows toward Fish Creek. The disturbed ground and the lack of construction of a definite channel for the runoff water increases sediment load in Fish Creek in this area. Water in Energy 2 pit is also higher in TDS than water flowing in Fish Creek, and the amount of TDS in Fish Creek downstream of the influent is increased.

Construction of roads for exploration and hauling associated with existing mining activities has also increased runoff erosion and sediment loads in Trout Creek watershed. In addition unreclaimed spoil piles which exist at Energy 1 and 2 operations add to sedimentation problems observed in Foidel and Fish Creeks.

Climate

The three mine sites of Energy Fuels are located within the regional box canyon of the Yampa River Valley. The local terrain of the area is rugged and separates the mine sites into distinct topographical regions.

Energy 1 is bounded to the south and east by Middle Creek, to the north by Foidel Creek, and to the west by Pinnacle Peak, extending to 2,236 meters (7,665 feet). The mine area slopes downward from an elevation of 2,316 meters (7,600 feet) in the south to 2,073 meters (6,800 feet) in the north. A high ridge extending to 2,287 meters (7,500 feet) on the north edge of Foidel Creek separates Energy 1 from Energy 2. Fish Creek marks the northern edge of Energy 2. Energy 3 is northwest of Fish Creek and is located about nine kilometers north-northeast of the other mine sites. A dry gulch cuts Energy III running from the northwest to southeast into Fish Creek. The elevation of Energy 3 is about 2,100 meters (6,800 feet).

Rough topography of the mine areas cause significant channeling of air masses passing the region. During the evening and early morning hours, air moves toward lower elevations. Therefore at Energy 1, night-time air masses are expected to move toward the Foidel Creek and then to the northeast. Similarly at Energy 2, night-time air drains down-valley to the northwest, and at Energy 3 to the southeast into the Fish Creek valley. During the afternoon hours when the sun heats the earth's surface, air tends to flow towards higher elevations.

Up-valley flow occurs less frequently in rough terrain than down-valley flow because of its dependence on strong solar heating. For example, on overcast days or during storms, air in the mid latitudes moves in from the west (prevailing westerlies) rather than following terrain features. Similarly when the ground is snow-covered, even abundant sunshine will not heat the earth's surface significantly during the afternoon, so up-valley flow is not produced. These restrictions on the frequency of up-valley flow are expected to apply to the Energy Fuels sites. It is estimated that down-valley flow occurs about 50 percent of the year and up-valley flow 10-20 percent of the year. The remainder of the year wind direction is variable.

Average hourly wind speed varies with the time of day. Wind speeds reach average maximum values during summer afternoons and are usually associated with up-valley flow. During this time, air is capable of substantial vertical mixing and therefore pollutants are dispersed easily. During the evening and early morning hours, average hourly wind speeds are low. Pollutants are poorly dispersed because there is little vertical mixing. At Energy Fuels it is estimated that afternoon wind speed will average 4 meters/second (mps) (8 mph) and evening wind speed 3 mps (6 mph).

Strong wind speeds greater than 10 mps (20 mph) will occur during abrupt weather changes or storms. Wind data collected at the Hayden weather station for the Yampa project indicate that strong winds occur about one percent of the time annually, primarily during the winter and spring months. Although the Hayden weather station was located nearly 25 kilometers (15 miles) from the Energy Fuels mines, the frequency of strong winds is expected to be similar at both locations.

Observations near the towns of Craig, Hayden, and Steamboat Springs indicate that the region often has no air movement at all. These calm conditions can occur any time of day but are far more frequent during the evening and early morning when air mixing is poor, and therefore potential pollution episodes most likely. Wind speeds of less than one mps (two mph) are expected nearly 20 percent of the time at the three sites.

Measurements of annual precipitation at the mine are unavailable, but historical records from the towns of Hayden and Yampa indicate that about 41 centimeters (16 inches) can be expected annually. Precipitation is expected to be greater during the winter months, arriving in the form of snow, averaging 305 centimeters (120 inches) per season. It is estimated that 90 days/year precipitation is greater than the detectable limit of .25 millimeters (.01 inches) at the Energy Fuels Mines.

Similar to the entire region, the mine area is subject to large seasonal and daily temperature variations. In July, temperatures are expected to vary from 27°C (81°F) during the day to 6.7°C (44°F) at night on the average. January extremes vary from an average of 0.0°C (32°F) during the day to -17°C (1.4°F) at night. The growing season is expected to be somewhat less than that recorded at Hayden, or about 60-70 days.

Air Quality

Ambient concentrations of the nationally regulated air pollutants are difficult to determine at the mines because no monitoring data are available. Therefore baseline concentrations of air pollutants are assumed to be the same as measured in other rural western regions. These background concentrations are: total suspended particulates, 20 $\mu g/m^3$; sulfur dioxide, 15 $\mu g/m^3$; nitrogen oxides, 15 $\mu g/m^3$; carbon monoxide, 400 $\mu g/m^3$; non-methane hydrocarbons, 50 $\mu g/m^3$; and ozone, 60 $\mu g/m^3$. A discussion of the measurements from which these backgrounds were determined can be found in the Regional Analysis Air Quality section of this Environmental Impact Statement.

Visibility at the mine is also assumed to be similar to the regional visibility. Maximum visibility on clear days is estimated to be about 100 kilometers (62 miles), but averages about 25 kilometers (15 miles) over the year. Worst case conditions of heavy fog reducing the visibility to less than 300 meters (0.2 miles) are expected to occur a few days every year.

Living Components

Soils

A detailed soil survey was prepared by the USDA-Soil Conservation Service for coal lease C-081330 (refer to Figure EII-12 for the soil map and mapping legend). The soil series and each mapping unit within the series is described in detail; it is necessary to read both descriptions to get full information about them. Symbols (in parentheses) following name of each mapping unit are used for identification.

Table EII-8 shows soil characteristics important to reclamation. The column labeled "topsoil" indicates suitability of soil material to support vegetative growth. Soils most suited for topsoil within the area to be mined, as indicated on the soil map, are the Routt series--map symbol Ro, and the Mord-Quander-Hub soils--map symbol MQ. The Haybro series is too clayey for good workability characteristics and would have compaction

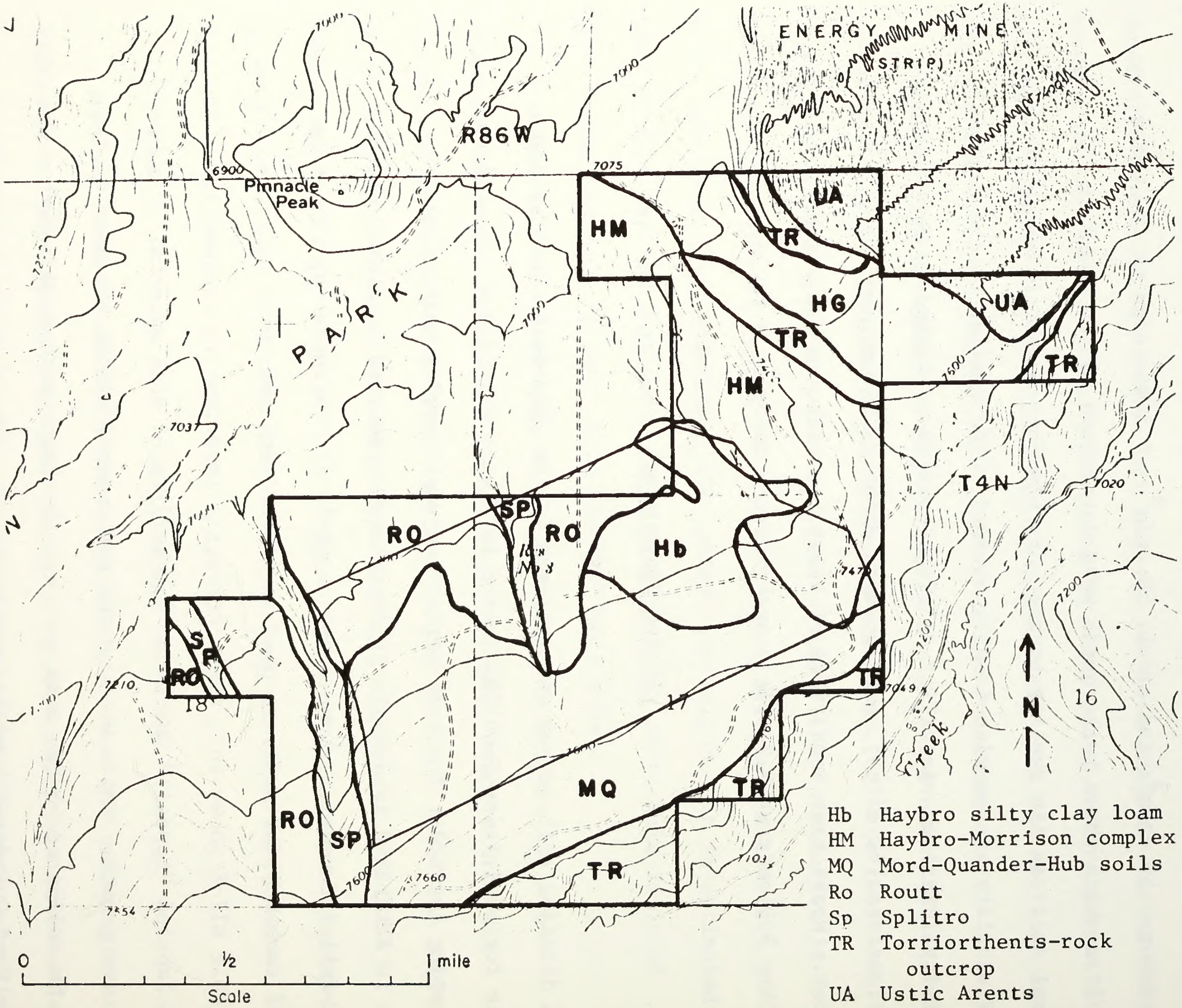


FIGURE EII-12

Soil map of Energy Fuels C-081330 coal lease.

SOURCE: USDA-SCS Routt County, unpublished data

TABLE EII-8

Soil Characteristics Important to Reclamation

Map Symbol	Soil Name	Composition Percent	Slope Percent	Depth Inches	Permeability	Available Water Capacity	Surface Layer	Subsoil or Equivalent	Substratum or to 60 inches	Topsoil
Hb	Haybro silty clay loam	100	12-25	20-40	Very slow	High	silty clay	silty clay	shale	poor-too clayey
HM	Haybro-Moyerson complex									
	Haybro part	55	25-65	20-40	Very slow	High	silty clay	silty clay	shale	poor-excess slope
	Moyerson part	40	25-65	10-20	Very slow	Low	silty clay	silty clay	shale	poor-excess slope
	Minor soils	5	25-65	ND[1]	ND	ND	ND	ND	ND	ND
MQ	Mord-Quander-Hub soils									
	Mord part	25	12-25	60	Moderate	High	loam	clay,loam	ND	fair, excess slope
	Quander part	60	12-25	60	Moderate	Moderate	loam	loam,clay, loam	cobbly loam	fair, excess slope
	Hub part	15	12-25	60	Moderate	High	loam	clay,loam	loam	fair, excess slope
Ro	Routt	100	3-25	60	Mod.-slow	High	loam,silt, loam	clay,loam, loam	ND	good
Sp	Splitro	100	25-65	10-20	Moderate	Low	loam	loam	sandstone	poor, excess slope
TR	Torriorthents-Rock Outcrop									
	Torriorthents part	75	25-65	10	ND	ND	ND	NL	sandstone	poor,excess slope, large stones
	Rock Outcrop part	25	25-65	0	ND	ND	ND	ND	sandstone	poor, no soil
UR	Ustic Arents	100	0-65	ND	ND	ND	ND	ND	ND	poor-no soil

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[1] Not done.

problems for seedbed preparation. The Splitro series occurs on slopes too steep to be accessible for topsoil. Table EII-9 shows the classification of the soils. Detailed soil series descriptions and their mapping unit descriptions for Figure EII-12 follow. Typical profile descriptions for each series are shown in Appendix D.

Haybro series

Soils of the Haybro series are moderately deep, fine-textured and well-drained; they form in Mancos shale and occupy upland slopes. The soils of this series are found throughout the study area.

Haybro soils have a dark grayish brown, very friable, granular, silty clay surface layer about three-six inches thick. The B2 horizon is an olive brown silty clay that has moderate angular blocky structure. An accumulation of lime is found at depths of 9-20 inches or lower in the subsoil; the silty clay substrata is olive-brown and contains lime that is visible in seams and streaks. Shale is found at a depth of about 30 inches. When this soil dries it contracts, forming wide and deep cracks; if poorly managed, erosion will be severe.

Sagebrush, rabbitbrush, needle grass, prairie Junegrass, and wheatgrasses are the principal native plants. Soils are productive and the level-sloping areas are suited to small grains.

"Haybro silty clay, 3-12 percent slopes (Hb)" occupies gently sloping to sloping uplands. Soils are underlain by shale at depths of 24-40 inches; it is an extensive soil. Areas are irregular in shape but large in size. This soil is like that described for the series.

TABLE EII-9

Classification of the Soils (Energy I Extension)

Series	Family	Subgroup	Order
Haybro	fine, montmorillontic, frigid	Borollic Vertic Camborthids	Aridisols
Hub	fine, loamy, mixed	Argic Cryoborolls	Mollisols
Mord	fine, montmorillontic	Boralfic Cryoborolls	Mollisols
Moyerson	fine, montmorillontic, calcareous, frigid	Ustic Torriorthents	Entisols
Quander	loamy skeletal, mixed	Argic Cryoborolls	Mollisols
Routt	fine, montmorillontic	Cryic Paleborolls	Mollisols
Splitro	loamy, mixed	Lithic Cryoborolls	Mollisols

SOURCE: Soil Survey, Routt County, USDA-Soil Conservation Service, Steamboat Springs, Colorado. Unpublished 1975.

Small areas of other soils that are silty clay are included in the mapping unit; some areas also have a thin cobble mantle on the surface. The soil is well drained; it is very slowly permeable, has moderate surface runoff, and a high water-holding capacity. When the soil dries, cracks up to two inches wide and three feet deep will form. The soil is used for native range that produces 200-800 pounds of air-dry forage per acre. Optimum ground cover is 35 percent; it has a potential to produce low-yielding small grains.

"Haybro-moyerson complex, 25-65 percent slopes (HM)" consists of about 55 percent Haybro soils and 40 percent Moyerson soils. Haybro soils occupy upper and lower portions of side-slopes; Moyerson soils occupy the middle section of side-slopes, ridgetops, and mounds; about 5 percent is shale outcrops. These soils have very rapid surface runoff; rill and sheet erosion are very active. These soils are used for range and wildlife. Haybro soils produce 1,500-3,000 pounds of air-dry forage per acre and optimum ground cover is 40-70 percent. Moyerson soils produce 100-500 pounds of air dry forage; optimum ground cover is 20 percent.

Hub series

This series comprises soils that are moderately deep and well drained. They occupy steep mountain slopes at elevations above 8,500 feet elevation. The soils are forming in colluvial-alluvial material overlying granitic boulders. The very dark-brown loam surface layer is about 7 inches thick. The next layer, about 6 inches thick, is also loam, but has been leached of organic matter and clay particles; clean sand grains are visible. The 11 inch subsoil layer is a dark-brown clay loam having moderate, fine, subangular, blocky structure; the underlying materials are loams that extend to 60 inches or more.

These soils will erode easily if the surface is left unprotected after logging, fires, etc. Because of the erosion hazard and the cold climatic zone, these soils are best suited to a coniferous woodland cover; some areas may be grazed. Trees that do well on these soils are lodgepole pine and spruce; some aspen are present, particularly in small areas where the A horizon is about 5 inches thick.

Mord series

This series consists of deep, well-drained, medium-textured soils on mountain slopes, developing on loess covered shales.

The grayish-brown and dark grayish-brown loam surface layer is about 14 inches thick. The next layer is brown loam, about 7 inches thick. The subsoil is pink and light-brown clay extending to 60 inches or more; it has thin patch clay films in the upper part and thick clay films in the lower part. These soils erode easily if the surface is unprotected; surface runoff is medium and erosion hazard is high.

The native plant cover consists of Thurber's fescue, nodding brome, slender and bearded wheatgrass, big blue grass, Idaho fescue, big sagebrush, silver sagebrush, snowberry, and some aspen. Because of slope, erosion hazard, and climate, the soils are best suited for native range.

"Mord-Quander-Hub soils complex, 12-25 percent slope (MQ)." Quander soils occupy about 60 percent of the area and are shallow over cobbly material. Mord soils are moderately deep over clay and occupy about

25 percent of the area; some stony spots and rock outcrops are present. Hub soils occupy about 15 percent of the area and are deep. These soils are well drained, moderately permeable, and have moderate water-holding capacities.

These soils are used for native range and wildlife; they are all placed in the same range site and managed together. The average yield of air dry forage is 2,000-4,000 pounds/acre; optimum cover is 50 percent.

Moyerson series

The Moyerson series is a shallow, well-drained, and fine-textured soil, forming in place on shale; slopes are undifferentiated. This soil is in complex with the Haybro soils. The very dark grayish-brown, silty clay, loam surface layer is about 5 inches thick and has fine subangular blocky to fine granular structure. The subsoil is of the same color as the surface but is a silty clay texture. The underlying material is shale at a depth of about 20 inches. Surface runoff on these clayey soils is very rapid and if vegetative cover is depleted they will erode severely.

Because the soils are so clayey, so shallow, and in a cold, dry, climatic zone, they are best suited to permanent grass; native species are western wheatgrass, squirreltail, Sandberg bluegrass, winterfat, low rabbitbrush, buckwheat, and big sagebrush.

Quander series

The Quander series is a deep, well-drained, medium-textured soil, developing in alluvial material on level to nearly level high mesas or terraces, and gentle to steep side slopes.

The very dark-brown, loam surface layer is 3-8 inches thick. The subsoil is a loam to light clay loam, and is also very dark-brown. The substrata is a cobbly or strong matrix that is loam filled. The rocks are mainly basalt. Surface runoff is medium and erosion hazard is moderate. Because of slope, erosion, and climate these soils are best suited to grass. Native species are mainly wheatgrasses, bluegrasses, fescue, needlegrasses, and big sagebrush.

"Rock Outcrop" consists of exposures of hard rock with a hardness of three or more. Sandstone makes up the major percent of the land type; however basalt, granite, or other hard geologic materials are included. Over 90 percent of the surface consists of barren rock exposures. This land type can be used best for wildlife, recreation, or watershed.

Routt series

The Routt series is deep and well-drained, forming on upland slopes in wind-blown material derived from shales and sandstones.

Routt soils have a very dark-brown loam surface layer about 22 inches thick with strong granular to moderate blocky structure. The next layer is a granular, leached, brown loam horizon about 4-12 inches thick. The subsoil is a dark yellowish-brown or brown clay loam that is transitional to the B2t. The B2t horizon has moderate angular blocky structure and extends to depths of 70-80 inches where it overlies silty material or bedrock. These soils are moderately susceptible to erosion, but are highly susceptible to slipping when saturated.

Native vegetation is principally oak brush, rose serviceberry, needle grass, Junegrass, elk sedge, and big sage; these productive soils are suited for range.

"Routt loam, 3-25 percent slopes (Ro)" occupies gently sloping to moderately steep upland and mountain slopes, generally above 7,000 feet elevation. It is an extensive unit and best typifies the series.

Included in mapping are small areas of shallow, gravelly, or stony soils. Some rock outcrops are also present, and some small areas are 20-26 inches of soil material over sandstone.

This well-drained soil has a thick, dark, granular surface layer. Natural fertility level is high for this soil; it takes water moderately slowly, but has a high water holding capacity.

This soil is used for range and wildlife, and is in native grasses and brushy plants, its most suitable use. The average yield ranges from 1,500-3,000 pounds; optimum ground cover is 40-70 percent.

Splitro series

The Splitro series is shallow and well-drained, forming in a mixture of loess and weathered fine grained sandstone material. Slopes are steep, generally north facing, and irregular in size and shape.

The black loam surface layer is about 9 inches thick and has fine granular structure. The 9-inch thick subsoil is a very dark-brown loam that is massive. The underlying material, from about 18 inches, is sandstone. Surface runoff on these slopes is rapid, and if the surface is not protected erosion could be severe.

Because of slope and climate, the soils are best suited to a permanent vegetative cover. Some common native species would be oak brush, serviceberry, big sagebrush, slender and western wheatgrass, needlegrasses, mountain brome, nodding brome and elk sedge.

"Splitro loam, 25-65 percent slopes (Sp)" occupies steep mountainous slopes. Included in the mapping are small areas of Routt loam and some small areas of Rock outcrop.

This well-drained soil is moderately permeable and has a moderate water holding capacity; it is best suited to permanent grass vegetation. If range is managed properly, a vegetative cover will be maintained and the soil will not erode. The average yield of air-dry forage is 1,500-3,000 pounds/acre, and optimum ground cover is 40-70 percent.

"Torriorthents-Rock Outcrop complex, excessively rocky areas (TR)." This unit occupies steep and very steep slopes where hard bedrock and boulders make up 75-90 percent of the surface area. There is enough soil material to support some vegetation, but it is sparse; soil is less than ten inches thick.

Because of slope, rockiness, and very shallow soil depth, this land type is best suited to wildlife, watershed, recreation, or aesthetic uses; surface runoff is very rapid. Forage production is estimated to be less than 250 pounds per acre.

"Ustic Arents (UA)" consists of coal strip-mined land where spoil is a mixture of sandstone, shale, and soil; enough fines remain to support vegetation on stable ridgetops.

Terrestrial Flora

Four primary vegetative community types are found in the general area of the Energy Fuels mines: grassland, sagebrush, mountain shrub, and cropland; and three subtypes: aspen, mountain shrub-rock outcrop, and mountain shrub-aspen. Much of the elevation in this area is a transition zone between mountain shrub and aspen communities, and is mapped as such. Hayland areas of the cropland type have been mapped separately; spoils, revegetated or not, are also mapped separately.

The vegetation has not been mapped in detail for the entire mining area. Therefore, broad vegetative types have been delineated on Figures EII-13 and EII-14. These types are described in following paragraphs, and are keyed to Figures EII-13 and EII-14. The ecological requirements of these general types are found in Chapter IV of the Regional Analysis. Type designations and numbers are those used by the BLM.

Grassland, type 1

A few isolated stands of grassland type are found in the area; they are mostly small parks among the mountain shrub and aspen types.

The vegetation consists primarily of needlegrasses (Stipa spp.), bluegrasses (Poa spp.), and bromes (Bromus spp.). Many very small areas of grassland type occur along the creek bottoms, but have not been mapped separately from the surrounding vegetation in this general map.

Sagebrush, type 4

Sagebrush community occurs on all sites below the elevational range of mountain shrub community; the transition zone between the two communities

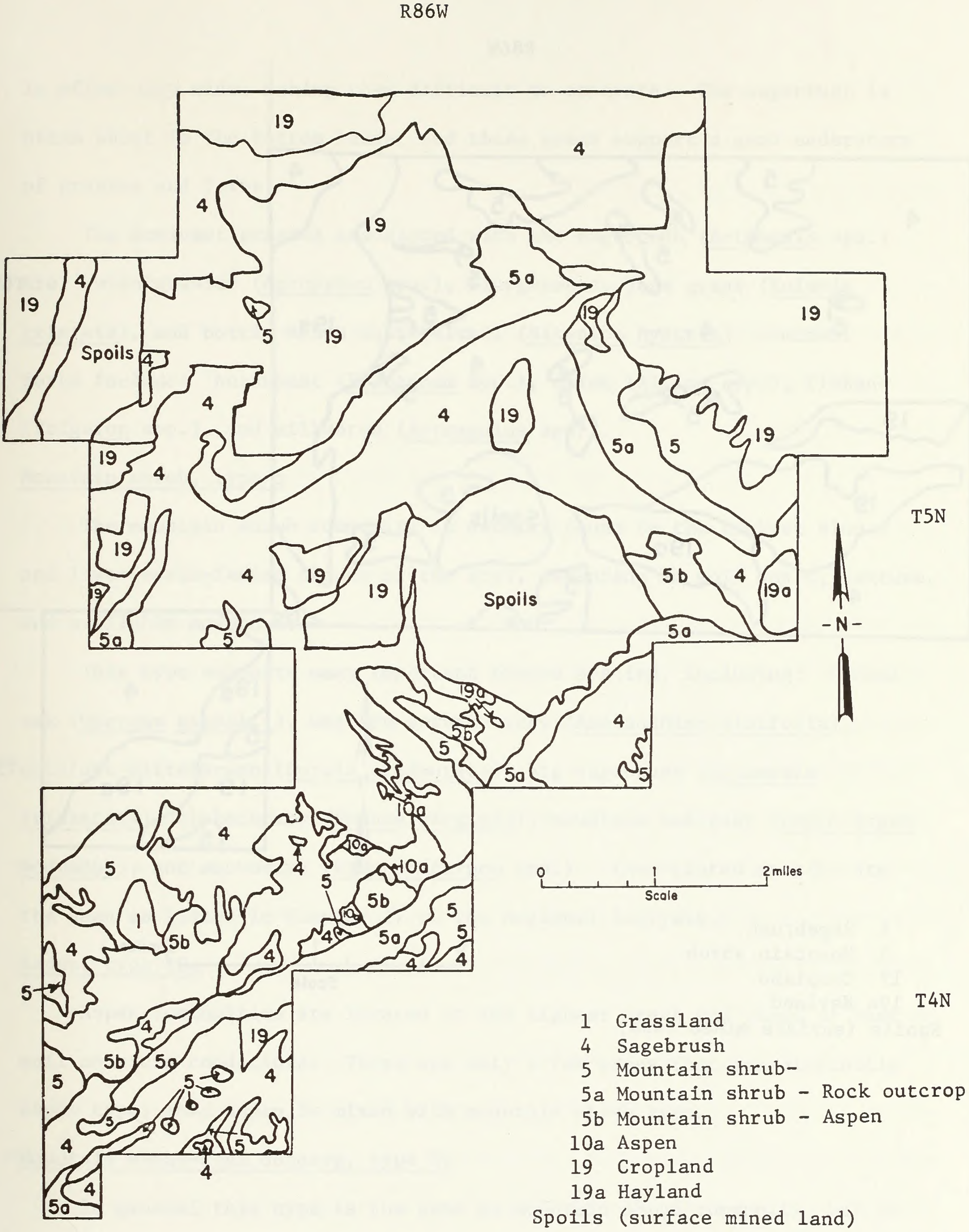


FIGURE EII-13

Vegetation of Energy Fuels 1 and 2.

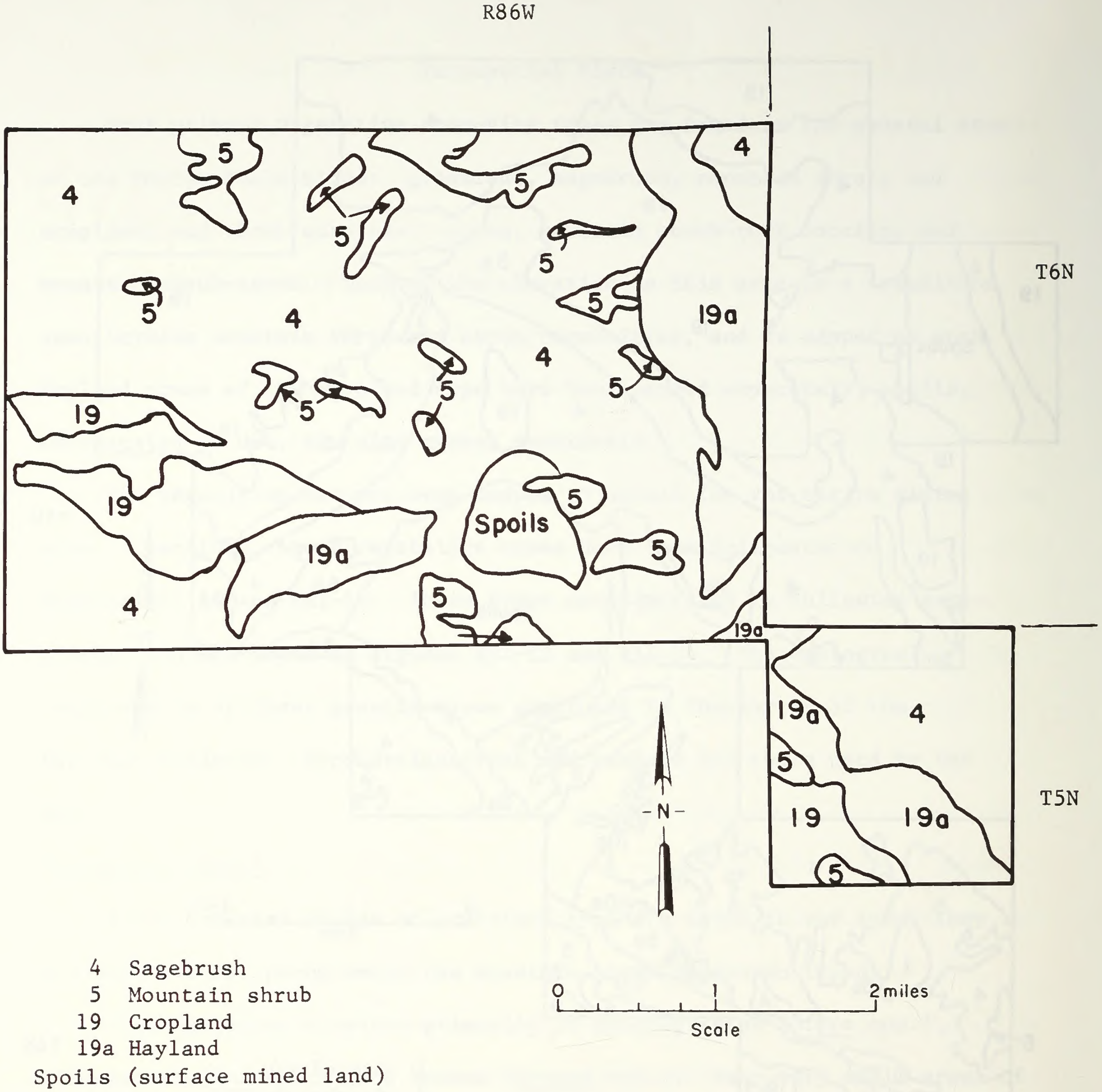


FIGURE EII-14

Vegetation of Energy Fuels 3.

is often very wide, making them difficult to separate. The sagebrush is often short in the bottom lands, and these areas support a good understory of grasses and forbs.

The dominant grasses associated with the sagebrush (Artemesia spp.) are: wheatgrasses (Agropyron spp.), bluegrasses, June grass (Koleria cristata), and bottle brush squirreltail (Sitanion hystrix); dominant forbs include: buckwheat (Eriogonum spp.), onion (Allium spp.), flebane (Erigeron spp.), and milkvetch (Astragalus spp.).

Mountain shrub, type 5

The mountain shrub community is usually found on the highest slopes and lower north-facing slopes of the area, depending on soil depth, texture, and available moisture.

This type supports many important browse species, including: Gambel oak (Quercus gambelii), western serviceberry (Amelanchier alnifolia), antelope bitterbrush (Pursia tridentata), big sagebrush (Artemesia tridentata), chokecherry (Prunus virginia), mountain mahogany (Cercocarpus montanus), and snowberry (Symphoricarpos spp.). (Associated species are the same as listed in Chapter IV of the Regional Analysis.)

Aspen, type 10a

Aspen communities are located in the highest areas and those of best soil moisture conditions. There are only a few areas that are distinctly aspen type; most aspen is mixed with mountain shrub type.

Mountain shrub-rock outcrop, type 5a

In general this type is the same as mountain shrub community, but is found on rock outcrops in the mining area. Understory vegetation is not as dense as mountain shrub community, and much of the area is covered by bare rock.

Mountain shrub-aspen, type 5b

The highest areas are covered by a mixture of mountain shrub and aspen communities. The areas range from nearly all aspen type to nearly all mountain shrub type. The species present in these areas are the same as in the individual communities.

Cropland, type 19

Croplands of the area are comprised of winter wheat, pastures, and hayland. Most of the winter wheat areas were formerly sagebrush type, located on the hillsides adjacent to creek bottoms. Production on the dryland farmed winter wheat is approximately 30 bushels/acre/year. Pasture lands are areas that have been seeded to grasses, mostly wheatgrasses (*Agropyron* spp.) and bromes, but are not productive enough, or are too rough for haying; some of these areas were formerly cultivated for winter wheat. Haylands are located in sub-irrigated creek bottoms, and have been designated (19a) on the vegetative map. The primary species seeded with the native grasses of the creek bottoms are: wheatgrasses, bromes, Timothy (*Phleum pratense*), and orchard grass (*Dactylis glomerata*).

Spoils

The areas classified as spoils are areas that have been surface mined. Some of these areas have been recently mined, shaped, topsoiled, and seeded, while some are old spoils that are unshaped and support scattered vegetation. For a more detailed description of vegetation being seeded on current operations, and that growing on old spoils, see Chapter III of the Regional Analysis.

There are no known rare or endangered plant species in the area; however a detailed analysis of the vegetation has not been completed.

Terrestrial Fauna

Wild fauna

A table indicating all wildlife species that are known to inhabit the Energy Fuels Mine area, as well as those that are expected to be found here, is located in Appendix D.

Big game

The Colorado Division of Wildlife (Colorado DOW) has divided the state into 126 Game Management Units (GMU) as indicated in Appendix D. The Energy Fuels mine complex is included in GMU 13.

Only two of the ten species designated as big game in Colorado are found within the area in substantial numbers. These two species, mule deer (Odocoileus hemionus) and elk (Cervis canadensis), occupy the proposed development area in varying densities dependent upon the condition of the food and cover, as well as climatic factors and the degree of harassment. Black bear (Ursus americanus) and cougar (Felis concolor) are found in the area in low numbers.

Another big game species that may inhabit the subject area is the white-tailed deer (Odocoileus virginianus). This species is suggested as a potential inhabitant of the development area, because of reported sightings a few miles to the west, and their known occurrence in similar habitats in northwestern Colorado.

Mule deer. Mule deer may be found in any portion of the subject area at any time of the year; however a greater population density occurs during the spring, summer, and fall months.

The Energy Fuels mine area provides marginal winter habitat and fair-to-good summer browse. The areas preferred by deer for summer use lie south of Routt County Road 27, with the exceptions of the butte northeast of Energy 1 (in sections 28 and 33) which is known to support some summer resident deer, and the areas bordering the drainages of Fish and Foidel Creeks north of Routt County Road 27 (see Figure EII-15).

Cover is provided by a combination of brush, aspen (*Populus spp.*), and topography, and appears to be adequate to meet the needs of the local deer. Water also appears to be of sufficient quality and quantity to meet their needs. Water is provided by Foidel, Fish, and Middle Creeks and several scattered ponds or stock tanks.

Some important deer foods that are found within the mine area are serviceberry, snowberry, bitterbrush, oak, common chokecherry, and big sagebush.

Researchers in similar areas of northwestern Colorado have identified preferred classes of foods for the mule deer as shown in Table EII-10. These study results are considered appropriate for the mine complex.

TABLE EII-10

Preferred Classes of Food for Mule Deer

	Percent of Diet			
Season	Shrubs & Trees	Forbs	Grasses & Grasslikes	Total
Winter	97	2	1	100
Spring	79	9	12	100
Summer	94	6	0	100
Fall	97	3	0	100

SOURCE: Kufeld, R.C. et al, Foods of Rocky Mountain Mule Deer

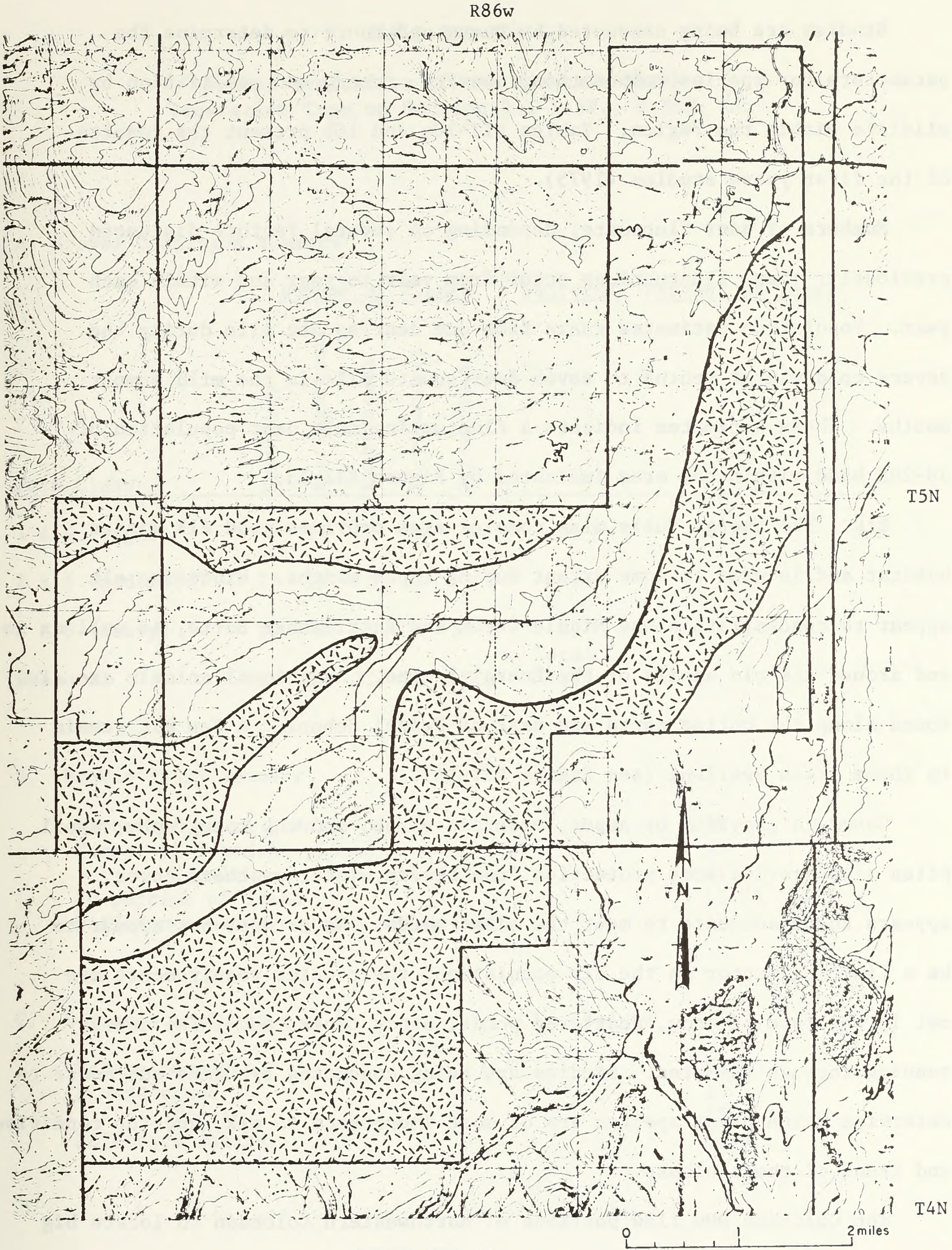


FIGURE EII-15

Preferred mule deer summer use areas (shaded).

Studies are being conducted by Dames and Moore to determine the parameters for species composition, density, trend, and utilization by wildlife within the region. Tables EII-10a and 10b present the results of the first years studies (1975).

Numbers of deer fluctuate, depending on several factors discussed previously; these fluctuations occur from year to year and within each year. Population estimates range from one deer/square mile during the severe cold winter months to seven deer/square mile in the mild summer months. These estimates indicate a fluctuating mule deer population of 38-263 head within the area indicated by Figure EII-15.

Elk. The Energy Fuels mine complex area provides good elk winter habitat and is used to some extent during these months. Wintering elk appear to concentrate along Middle Creek and Rattlesnake Butte, as well as in and around the old spoils of the Energy 1 mine. Additional animals are also found along the buttes north and east of Foidel School. A few elk remain in these areas yearlong (see Figure EII-16).

Cover is provided by aspen, mountain shrub, and the topography; spoil piles also provide some protection from severe winter weather; cover appears to be adequate to meet the elks' needs. Water does not appear to be a limiting factor on the elk population; their water requirements are met in the form of snow, scattered ponds, stock tanks, and three creeks running through the area. Studies are being conducted by Dames and Moore to determine which plant species are of most importance to elk, and the condition and trend of these plants.

The Colorado DOW flew portions of northwestern Colorado to locate big game concentrations; the area around the Energy Fuels mine complex was

TABLE EII-10a

Browse Evaluation of the Mountain Shrub Vegetation Type on Section 21, T.5N., R.86W. 1/

A. Browse Condition Summary

Form Class	Number of Plants Snowberry	 Big Sagebrush	 Rabbitbrush	 Serviceberry	 Bitterbrush	Subtotal	Percent of Total
1 & 4 (light)	2	14	15	0	0	31	21%
2 & 5 (moderate)	27	17	2	22	3	71	47%
3 & 6 (heavy)	10	1	5	6	27	49	32%
Subtotal	39	32	22	28	30	Total 151	

B. Browse Trend Summary

Number of young plants	39
Number of decadent plants	12
Total	51
20 percent of Total	10.2%
Difference between young and decadent	27

C. Key area evaluation

	Points
Browse condition	10
Browse trend	15
Total	25
Adjective rating	Good

1/ SOURCE: Baseline Environmental Report (Dames and Moore 1975).

TABLE EII-10b

Browse Evaluation of the Mountain Shrub Vegetation Type on Section 9, T.4N., R.86W. 1/

A. Browse Condition Summary

	Number of Plants				Subtotal	Percent of Total
Form Class	Snowberry	Big Sagebrush	Gambel Oak	Serviceberry		
1 & 4 (light)	10	12	14	5	41	32%
2 & 5 (moderate)	23	22	10	12	67	52%
3 & 6 (heavy)	8	3	2	7	20	16%
Subtotal	41	37	26	24	Total 128	

B. Browse Trend Summary

Number of young plants	16
Number of decadent plants	12
Total	28
20 percent of Total	5.6 (2.8)
Difference between young and decadent	4

C. Key area evaluation

	Points
Browse condition	10
Browse trend	10 (15)
Total	20 (25)
Adjective rating	Fair to Good

1/ SOURCE: Baseline Environmental Report (Dames and Moore 1975).

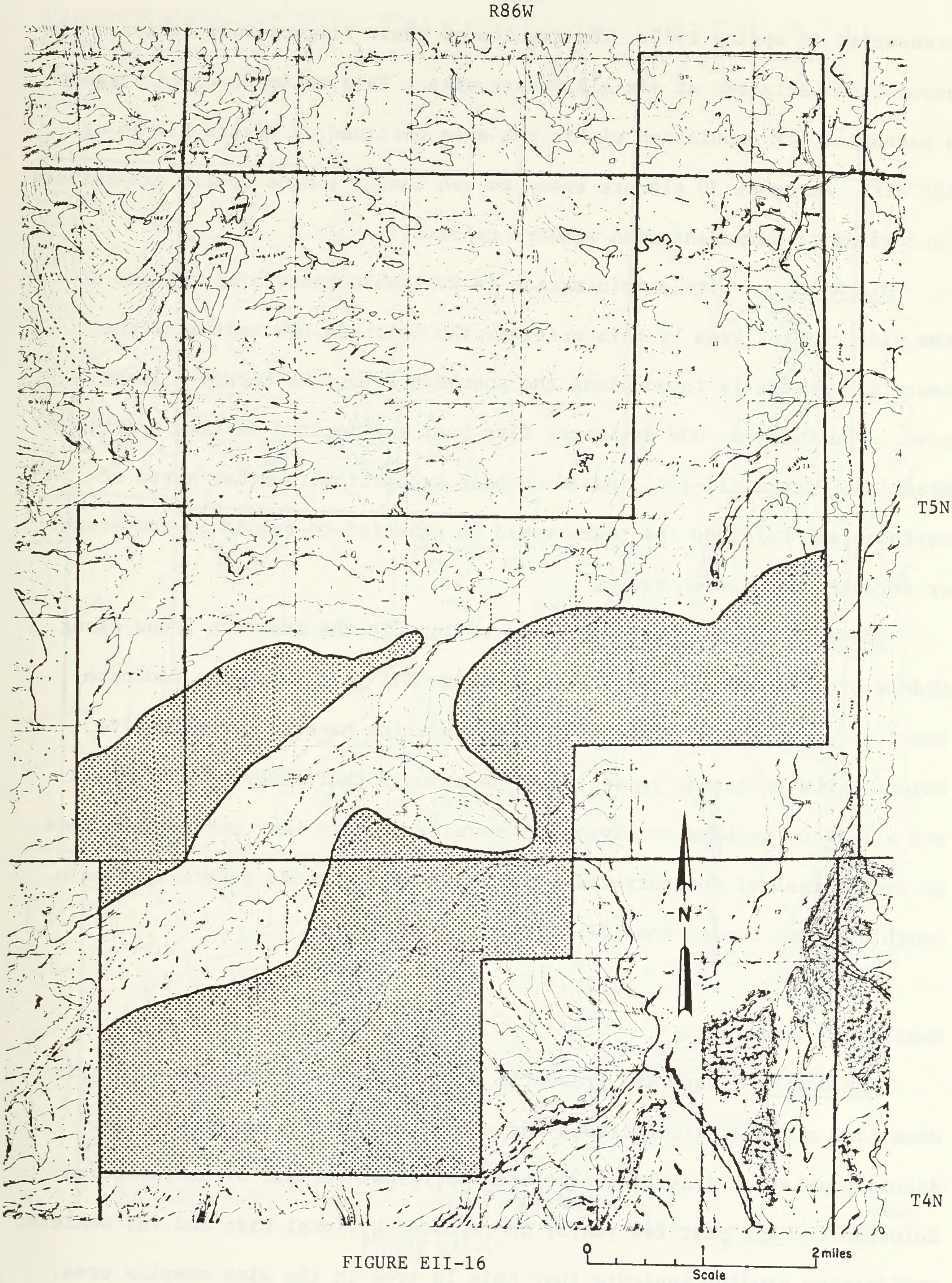


FIGURE EII-16

Preferred elk winter use areas (shaded).

transected in spring 1975. The results of these flights indicated a population estimated at six elk/square mile. This estimate would suggest a potential elk population within the area outlined on Figure EII-16 of 225 elk. At least 30 elk are known to use Energy 1 mine spoils extensively (according to permanent mine workers reports.)

Black bear. Little information is available concerning the use of the mine complex area by this species. The Colorado DOW indicates that bears are generally found along the southern fringe of Energy 1 lease area. The Colorado DOW estimates five bear are located in this general area (see Figure EII-17). Based on bear habitation in other parts of northwestern Colorado the bears would be expected to remain in the brushy or forested vegetation types.

Cougar. The only cougars known to inhabit the area are found along Middle Creek south of Energy 1 (see Figure EII-17); estimates indicate two-four animals. No reports of lion predation have been reported to Colorado DOW in recent years, so it is assumed that cougar predation is not a serious problem to livestock operators. Both bear and cougars tend to avoid areas of concentrated human activity and would generally remain south of Routt County Road 27.

Small game mammals

Lagomorphs. Data are presently not available to indicate population densities or habitat conditions for species of this group of mammals. Rabbit population densities have been very low over all of northwestern Colorado for the past few years, as reported by local hide and fur dealers; preliminary studies indicate that this is true in the mine complex area.

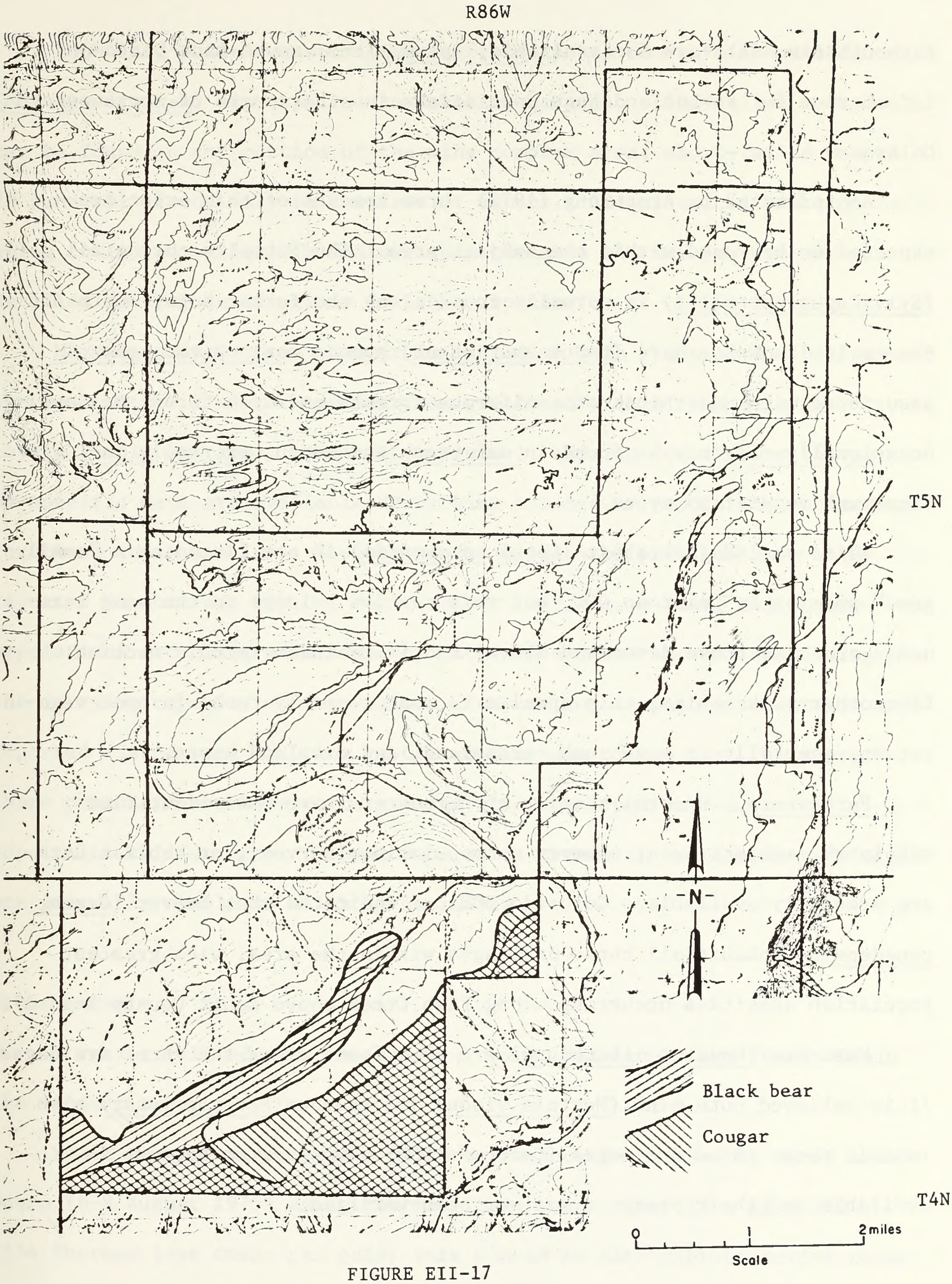


FIGURE EII-17

Black bear and cougar preferred use areas.

Although firm data are not available, assumptions can be made based on information for rabbit and hare populations in other parts of northwestern Colorado.

As indicated by Armstrong (1972) three species of this order are expected to be found within the subject area. The Nuttalls cottontail (*Sylvilagus nuttallii*) is normally found along the forest edge, south of Energy 1. Snowshoe hare (*Lepus americanus*) spends most of the year associated with underbrush of coniferous forests and open forest meadows; occasionally they may be found in oak brush and aspen, or rarely in sagebrush vegetation types.

White-tailed jackrabbit (*Lepus townsendii*) is not listed as a "small game" species by Colorado DOW, but this species belongs to the same taxonomic order as those described above, and is included in this section. Like other jackrabbits, this species is most commonly found in open vegetation, generally in sagebrush, grassland, and cropland types.

Furbearers. Several species of furbearers have been identified within the subject area; however no population, harvest, or habitat data are presently available. Colorado DOW has indicated that beaver (*Castor canadensis*) inhabit all three drainages within the area, with greatest population densities occurring along Fish Creek above Routt County Road 27.

Muskrats (*Ondatra zibethicus*) are also found along the three drainages. It is believed both mink (*Mustela vison*) and raccoon(*Procyon lotor*) also inhabit these three drainages (Colorado DOW). However no harvest is available and their presence has not been verified.

Both long-tailed weasel (Mustela frenata) and short-tailed weasel (Mustela erminea) are expected to inhabit the area. Long-tailed weasel can be found in any portion of the mine complex area; short-tailed weasel is generally found only in conifers or aspens. Additional information is being collected on small mammals within the area and may provide more detailed habitat descriptions for these species.

Mammalian predators. Cougar is listed as both predator and big game species. Other predator species that are found within this site are coyote (Canis latrans), bobcat (Lynx rufus), and red fox (Vulpes fulva). No specific data are available describing habitat or population parameters for these three species. However since no predator problems have been reported to Colorado DOW, it would appear that fox, bobcat, and coyote populations are being maintained by native prey, and are not surpassing the carrying capacity of the region. Fox and coyote population trends are reported rising, and with low rabbit populations of the past few years these predators may have to turn to an alternate food source, or the population will decline. Bobcat population trends in northwestern Colorado are generally stable to slightly declining.

Other mammals

A variety of rodents, insectivors, bats, and skunks are found within the subject area.

Small mammals were trapped on three consecutive nights by Dames and Moore (6-8 August 1975) using Sherman live traps. Four 12 x 12 grids (144 Sherman live traps per grid) were placed in each representative cover type, namely aspen, mountain shrub, sagebrush, and grassland. In addition to identifying, weighing, and recording the reproductive status of captured animals, vegetation at each grid site was sampled to compare mammalian diversity with cover types.

Twenty-one mammal species were recorded during the study. Aspen and mountain shrub types had the greatest species composition, with 14 and 13 species respectively. Eight species were identified in sagebrush habitat, and only two in grassland. Mountain shrub and aspen areas appear to support a more diverse mammal fauna than do sagebrush or grassland, because a greater array of microhabitats are associated with woodland growth-form and food resource. Many mammals utilize more than one community (Appendix D).

All species were trapped in the aspen and mountain shrub areas, but only deer mice were trapped in sagebrush and meadow communities (Table EII-11). Since the diversity was greatest in mountain shrub followed by aspen woodlands, these communities must be considered more important habitats for small mammals than sagebrush or meadows. The diets of the six species trapped in mountain shrub type ranged from animal matter to seeds and vegetation, suggesting that not only a diverse habitat exists but a diverse food resource base.

Unlike the woodland communities, sagebrush and meadows are more open and more restricted in growth-form. The deer mouse, a predominantly seed-eating species although weakly omnivorous, was the only species to appear in these communities. The grasses at the meadow grid site were established through human manipulation, and the presence of deer mice and the absence of other rodents typifies the relationship between deer mice and exotic communities.

TABLE EII-11

Small Mammals Live-Trapped on the Four Mammal Grids - Energy Fuels Mine
August 1975

	Aspen	Oak	Sagebrush	Meadow	Total
Trap Nights	432	432	432	432	1,728
Total Species	5	6	1	1	13
Total Individuals	24	45	19	5	93
Total Biomass (gms.)	595	889	516	78	2,078
Trap Nights/Catch	18	9.6	22.7	86.4	
Percent Captures/Grid	5.6	10.4	4.4	1.2	
Density (Individuals/acre)	3.6	6.7	2.8	0.7	

Trapped Population Only

Species	Comp.	Biomass	Comp.	Biomass	Comp.	Biomass	Comp.	Biomass
Shorttail Weasel	-	-	1	56	-	-	-	-
Least Chipmunk	11	290	3	87	-	-	-	-
Deer Mouse	1	23	18	266	19	516	5	78
Boreal Redback Vole	3	96	7	176	-	-	-	-
Mountain Vole	6	141	12	252	-	-	-	-
Western Jumping Mouse	3	45	4	52	-	-	-	-

SOURCE: Dames and Moore, 1975.

Data (Table EII-12) indicate less breeding activity occurs in aspen woodland than in the other communities. This may reflect shorter reproduction seasons at higher elevation.

TABLE EII-12

Reproductive Status of Small Mammals Trapped on Four Grids, Energy Fuels Mine - August 1975

	Active		Inactive		
	Male	Female	Male	Female	Juvenile
Aspen					
Least Chipmunk	-	2	2	3	4
Deer Mouse	-	1	-	-	-
Boreal Redback Vole	2	-	1	-	-
Mountain Vole	1	2	-	1	2
Western Jumping Mouse	-	-	1	-	2
Oak Brush					
Shortail Weasel	-	-	-	-	1
Least Chipmunk	-	-	1	1	1
Deer Mouse	2	4	1	-	11
Boreal Redback Vole	2	2	2	1	-
Mountain Vole	1	1	1	1	8
Western Jumping Mouse	-	2	2	-	-
Sagebrush					
Deer Mouse	4	11	-	-	3
Grass					
Deer Mouse	2	1	1	-	1

SOURCE: Dames and Moore, 1975.

Waterfowl

Several species of waterfowl are known to migrate through the region, and many stop off at some ponds or creeks during this period. At least six species are known to nest within the area: Mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), american widgeons (*Mareca americana*), green-wing teal (*Anas cyanoptera*), cinnamon teal (*Anas cyanoptera*), and blue-winged teal (*Anas discors*) are the known nesters; several others are possible. Nesting densities are expected to be light and restricted to the creeks and ponds in areas that are not heavily grazed.

Peak for waterfowl numbers moving through the mine complex area is probably in March or April. Waterfowl food is restricted to aquatic habitats and adjacent lands, with little use of croplands.

Upland gamebirds

Sage grouse (*Centrocercus urophasianus*). Sage grouse have been reported mainly in the northwest portion of the site (Figure EII-18). This species is found in huntable quantities west and northwest of Energy 2. Population size has been estimated around 200 birds, with an estimated 10-20 percent (20-40 birds) located in close proximity to Energy 2 (Colorado DOW). Population condition and habitat parameters are not presently available. Bird identification transects, established by Dames and Moore, were run in the spring, summer, fall, and winter of 1975. Bird species identified during the reading of these transects were included in the species list located in Appendix D.

Sharp-tailed grouse (*Pedioecetes phasianellus*). This grouse species is known to inhabit certain areas along northern and western perimeters of the subject area. One dancing ground has been identified one mile northwest of Pinnacle Peak (Figure EII-18). No additional information is presently available.

Blue grouse (Dendragapus obscurus). These birds may be found scattered throughout the mine complex area, generally in aspen vegetation type. More blue grouse are known to inhabit the conifer forests south of the subject area. Population densities, habitat conditions, or season of use information are not available for blue grouse at this time.

Hawks, eagles and falcons

Several species of this order have been seen within the area. The rough-legged hawk (Buteo lagopus) is a common winter resident, as is the firruginous hawk (Buteo regalis). The Swainson's hawk (Buteo swainsoni) and the American kestrel (Falso sparverius) are summer visitors. The Golden eagle (Aquila chrysaetos) and the red-tailed hawk (Buteo jamaicensis) are yearlong users of the area. Only the golden eagle and American kestrel are known nesters within the study area.

Other birds

Very little information is available for non-game birds inhabiting this area; some of the most obvious birds have been recognized on the site. The presence of other bird species is assumed, based on a literature review conducted by Dames and Moore (1975).

Amphibians and reptiles

Very little data are available for occurrence or habitat requirements of amphibians and reptiles within this area. Some generalizations can be

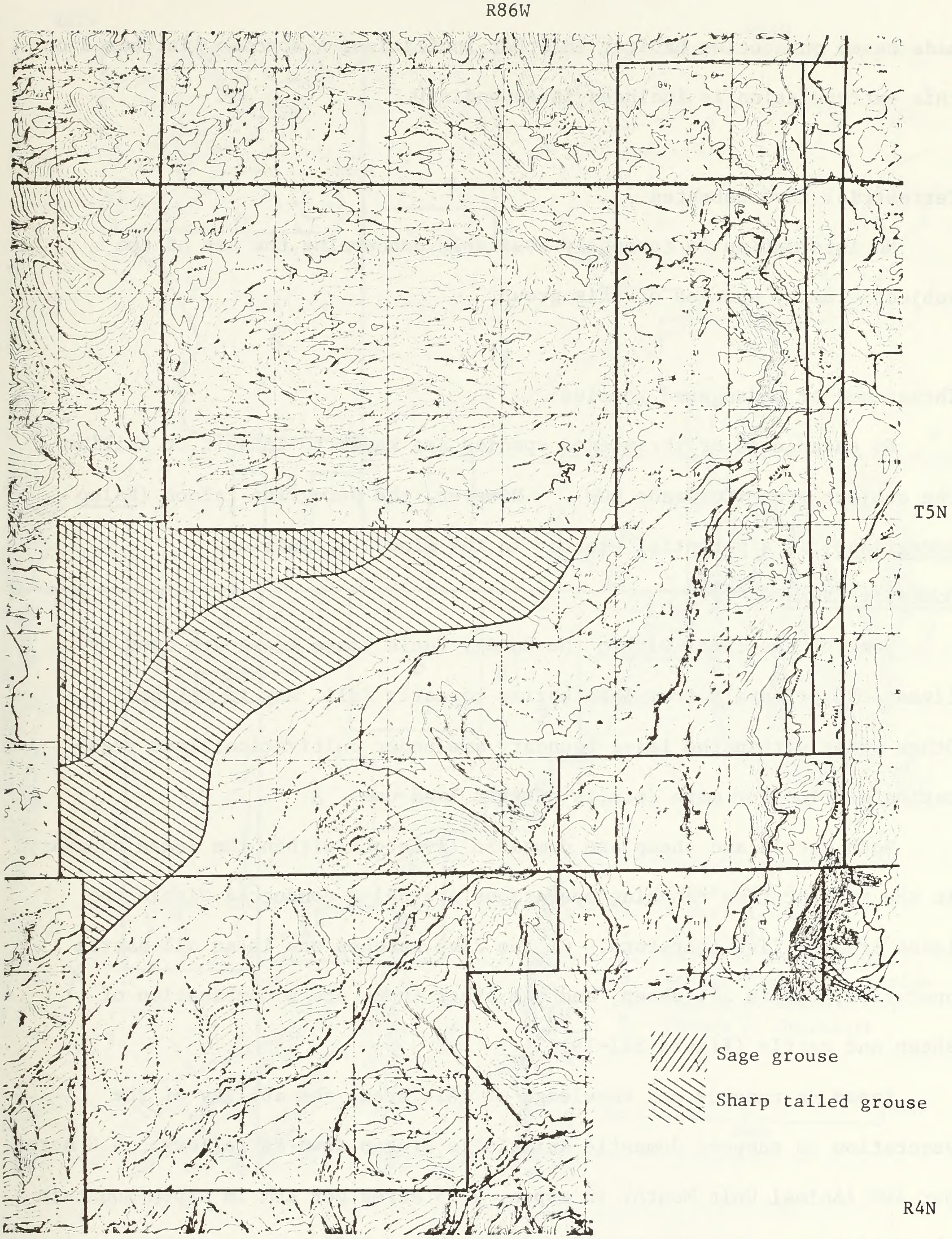


FIGURE EII-18

Sage grouse and sharp-tailed grouse preferred use areas.

made based on species habitat in other localities; a species list based on this extrapolation is included in Appendix D.

Terrestrial invertebrates

No information is currently available concerning the use of the subject area by species of this group.

Threatened or endangered species

No endangered or threatened species are known to inhabit or utilize the subject area (Colorado DOW). However, the peregrine falcon (*Falco peregrinus*) is a potential visitor in the mine's vicinities.

Domestic fauna

Some of the lands within the Energy Fuels lease areas are used by livestock, primarily from late spring to early fall, May to October. Other areas within the lease boundary are under cultivation; (see vegetation section for more details on this land use).

Both cattle and sheep are domestic livestock within the lease boundary. At the present time ranching operations are being conducted within the lease area by five operators. Of the five ranches one is an all-cattle operation, one is all-sheep, and the other three are a combination of sheep and cattle (Figure EII-19).

Based on records and knowledge of this area, the ability of the vegetation to support domestic animals is broken down as follows: 4.0 acres per AUM (Animal Unit Month) in aspen, 4.25 acres per AUM in aspen-mountain shrub, 4.5 acres per AUM in mountain shrub and 7.75 acres per AUM in sagebrush (BLM, Craig District Office).

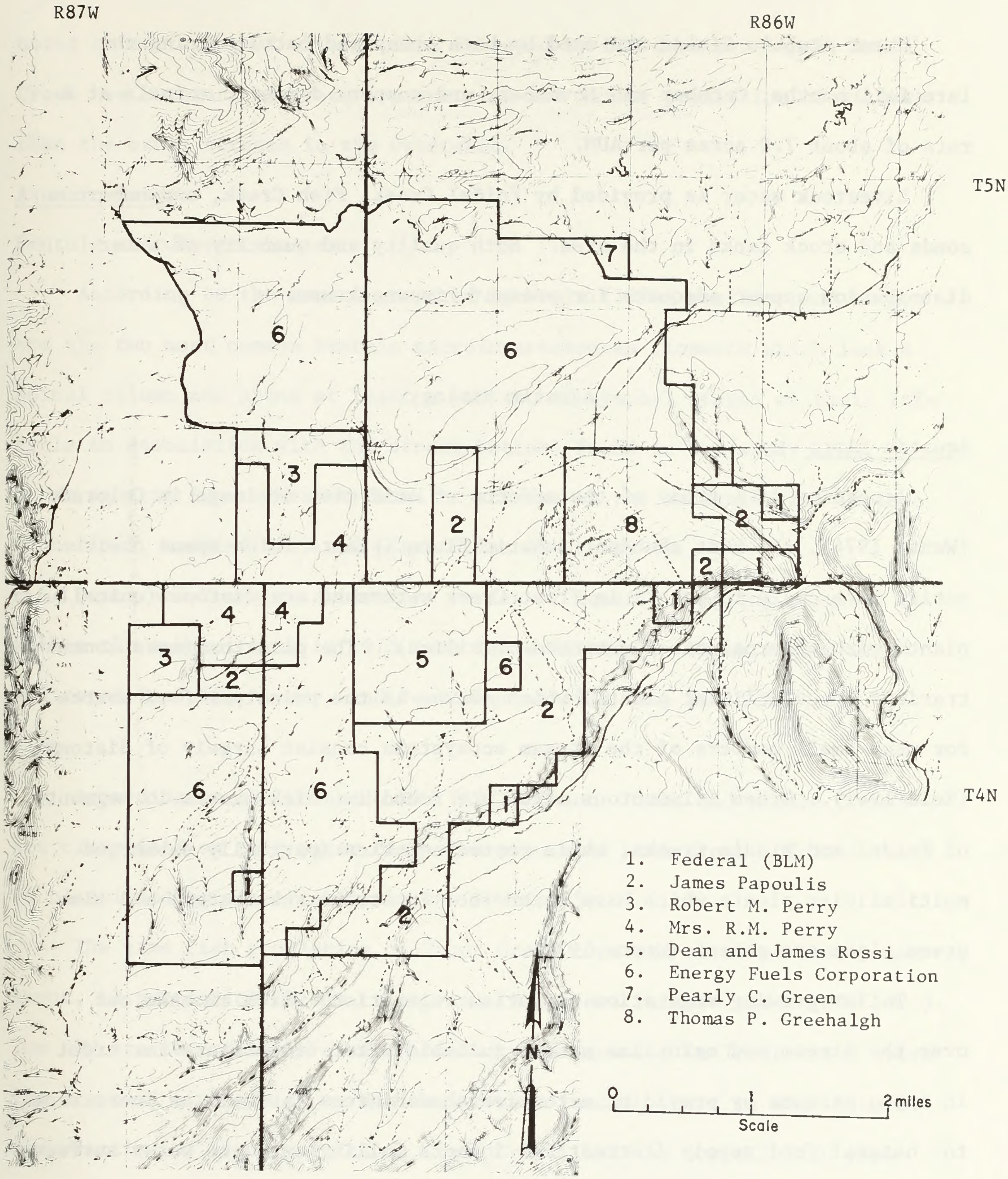


FIGURE EII-19

Landownership as of June 1975.

Wheat stubble fields are used by both sheep and cattle during the late fall months, October and November, and support domestic animals at a rate of about 7.0 acres per AUM.

Livestock water is provided by Foidel Creek, Fish Creek, and numerous ponds and stock tanks in the area. Both quality and quantity of water distribution appear adequate for present livestock use.

Aquatic Biology

Aquatic flora

According to a study of the effects of acid mine drainage in Colorado (Wentz 1974), the most abundant aquatic flora (plants which spend their entire life cycle in water) in Trout Creek watershed are diatoms (unicellular plants with external cases composed of silica). The plankton (mass concentrations of unicellular plants) which serves as the principal food source for many small members of the stream ecosystems consist largely of diatoms (Reid 1961). Green filamentous algae are found in thick masses in segments of Foidel and Middle Creeks, while rooted aquatics (partially submerged multicellular plants which have taken root in stream substrates) and blue green algae are absent (Wentz 1974).

Taller growing vegetation (riparian vegetation) which extends out over the stream bed maintains a more suitable water temperature for trout in these streams by providing extensive shaded areas, as well as increasing the natural food supply (terrestrial insects falling onto the water surface from overhanging vegetation). Riparian vegetation along Trout Creek was noted to be fair-good at locations surveyed by EIS team personnel; Trout Creek has a relatively more concentrated and taller population of willows than the other streams in the watershed.

Aquatic fauna

Benthic macroinvertebrates

According to the report prepared by Wentz (1974) mayflies and midges are the two most common benthic macroinvertebrates (insects which lack a spinal column and spend at least a portion of nymphal stages of their life cycle in association with the stream bottom) found in the study area. Other aquatic invertebrates found in streams in the analysis area include stoneflies, caddisflies, and black flies (Wentz 1974).

Dames and Moore established a series of aquatic sampling stations within the subject area in 1975 (see Table EII-12a). These sights were monitored in July, August, and September of 1975 (see Table EII-12b).

Fish

According to the Colorado DOW (1972) Trout, Fish, and Middle Creeks are classified as cold water fisheries populated with trout. Foidel Creek is classified as a nonfishery by the DOW (1975).

The game fish population of Trout Creek consists of 80 percent brook trout, 10 percent cutthroat trout, and 10 percent rainbow trout (DOW 1972). The DOW stocks catchable-sized rainbow trout annually in Trout Creek above the proposed mining site on National Forest lands. There is some natural reproduction of trout species in Trout Creek, and the overall fish population condition is stable. The flow of Trout Creek is interrupted at some locations by beaver dams.

TABLE EII-12a

Aquatic Sampling Stations in the Energy Fuels Area [1]

Fish Creek	
Upper Station	NW 1/4 SE 1/4 Section 34 R87W T5N
Middle Station	SE 1/4 SW 1/4 Section 17 R86W T5N
Lower Station	NW 1/4 NE 1/4 Section 1 R86W T5N
Foidel Creek	
Upper Station	NW 1/4 NE 1/4 Section 7 R86W T4N
Lower Station	NW 1/4 SE 1/4 Section 29 R86W T5N
Middle Creek	
Upper Station	SE 1/4 NE 1/4 Section 19 R86W T4N
Lower Station	NE 1/4 NW 1/4 Section 10 R86W T4N
Trout Creek	
Upper Station	SE 1/4 NE 1/4 Section 18 R85W T5N
Lower Station	NW 1/4 NE 1/4 Section 36 R86W T6N

[1] **SOURCE: Baseline Environmental Report (Dames and Moore 1975).**

TABLE EII-12b

Abundance and Diversity of Benthic Macroinvertebrates from One Surber Bottom Sample at Each Station Collected in July, August, and September 1975 [1], [2], [3]

Station	Number of Individuals			Average For Summer Season	Number of Taxa			Average For Summer Season	Diversity			Average For Summer Season
	July	Aug	Sept		July	Aug	Sept		July	Aug	Sept	
Fish Creek												
Upper	140	307	750	399	8	12	20	13	2.0	2.7	2.7	2.5
Middle	10	998	589	532	1	15	11	9	0.0	2.7	1.8	1.5
Lower	18	2399	4058	2158	6	20	16	14	2.2	2.3	1.4	2.0
Middle Creek												
Upper	230	832	294	452	18	10	8	12	2.5	0.9	1.6	1.7
Lower	130	151	672	318	13	10	21	15	2.4	2.6	3.3	2.8
Foidel Creek												
Upper	90	1013	-	552	8	16	-	12	1.3	1.8	-	1.6
Lower	486	3170	-	1828	7	16	-	12	1.8	1.8	-	1.8
Trout Creek												
Upper	29	546	775	450	11	17	18	15	2.8	3.3	2.3	2.8
Lower	76	6082	715	2291	7	15	20	14	2.3	2.1	2.6	2.3

[1] SOURCE: Baseline Environmental Report (Dames and Moore 1975).

[2] For more detailed analysis of data, see Appendix D.

[3] See Table EII-A for station locations.

Studies conducted by Dames and Moore (1975) indicated a low quality sports fishery in the immediate vicinity of the Energy Fuels mines (see Table EII-12c).

Overall water quality of Trout Creek is rated as fair for trout, being limited by water temperatures; 70°F is the maximum temperature to which trout should be exposed. Waters of the Trout Creek watershed would approach 65°-70°F, and above average turbidity measurements (sediment load transported by stream) would occur during the late summer and early fall. The physical quality of Trout Creek may also be classified as fair to good. The pool-riffle (critical spawning and feeding habitat for trout) ratio in Trout Creek is approximately 50-50 (50 percent pools and 50 percent riffle areas) while a 30-70 ratio is described as ideal by the Colorado DOW (1972). The natural channel of Trout Creek is meandering with steep, undercut banks in its lower reaches south and east of the proposed mining activities.

Food supply available to the trout population in Trout Creek (primarily aquatic invertebrates) is fair in quality and quantity, and general condition of the fish in the stream is rated as fair.

There are very few non-game species to compete with trout for available habitat in Trout Creek. Non-game species which are present in the stream are white suckers, mottled sculpins, and red shiners (Everhart and Seaman 1971).

Fish Creek is populated with brook and rainbow trout in a 70-30 percent species composition ratio respectively (Colorado DOW 1972). The stream is stocked with rainbow trout at random time intervals by the DOW, at locations above proposed mining activity. There is some natural reproduction of brook trout in Fish Creek, and overall fish population condition is stable.

TABLE EII-12c

Numbers and Kinds of Fish Captured at Each Station in August 1975 1/, 2/

Species		Fish Creek			Foidel Creek		Middle Creek		Trout Creek	
		Upper	Middle	Lower	Upper	Lower	Upper	Lower	Upper	Lower
MINNOWS										
Shiner	(Notropis spp.)	-	1	3	-	-	-	-	3	-
Speckled dace	(Rhinichthys osculus)	-	41	1	-	3	-	3	54	17
Flathead minnow	(Pimephales promelas)	-	-	4	-	-	-	-	-	-
SUCKERS										
White sucker	(Catostomus commersoni)	-	7	2	-	5	-	21	1	4
Mountain sucker	(Catosomus platyrhyrchus)	-	-	-	-	-	14	32	1	-
SCULPINS										
Mottled sculpin	(Cottus bairdi)	12	-	3	-	-	-	-	22	4
TROUT										
Brooktrout	(Salvelinus fontinalis)	-	-	-	-	-	1	-	-	-

1/ SOURCE: Baseline Environmental Report (Dames and Moore 1975).

2/ See Table EII-A for station locations.

Physical and chemical quality of Fish Creek is poor in the vicinity of the proposed actions. Critical limiting factors for the fish population in Fish Creek on the Energy Fuels property are: (1) water temperatures which are marginal (greater than 80°F in some stream segments during the summer and early fall; 60°F-65°F is generally considered optimum for trout), (2) more pool areas than riffle areas (65 percent pools to 35 percent riffles), (3) generally turbid water flow clarity throughout most of the year, (4) low average flow velocity, (5) widely meandering natural stream channel with steeply undercut and eroding banks, and (6) lack of an adequate food supply (macroinvertebrates) for the existing trout population. The only non-game fish species which might occur in Fish Creek are white suckers, sculpins, and red shiners.

Fisheries population of Middle Creek consists of brook and rainbow trout in a 50-50 ratio (Colorado DOW 1972). The stream is occasionally stocked (at irregular time intervals) with rainbow trout by the DOW, and there is some natural reproduction of brook trout in the upper reaches of the stream. The streamflow is interrupted by beaver dams at some locations. General quality of Middle Creek in the vicinity of the proposed action is poor due to: (1) marginal water temperatures for trout, (2) high turbidity of stream flow, (3) more pools than riffle areas, (4) marginal fish food supply for trout, and (5) low velocity flow and meandering stream channel (taken from Colorado DOW's Stream Rating System). Middle Creek may also be assumed to contain some suckers and sculpins.

Although Foidel Creek is considered to be a non-fishery, field observations during June 1975 by EIS team personnel indicated that the stream does flow during spring runoff and for at least a portion of the summer.

It may be assumed that some members of the permanent fish population in Middle Creek migrate into Foidel Creek during these periods. Quality of the intermittent flow of Foidel Creek is poor, characterized by low velocity, high sediment loads, marginal water temperatures, lack of riffle areas, and low diversity of aquatic insects.

Cultural Components

Archeological Resources

During the summer of 1975, Dr. Alan Olson of Denver University, spent five man-days conducting a reconnaissance survey of several Energy Fuels properties. Dr. Olson's report to the Energy Fuels consultants (September 18, 1975) indicates:

> that the area is initially unsuitable for permanent occupation. However, there is the potential for seasonal utilization prior to European settlement of the region. This activity, such as hunting or gathering undoubtedly occurred, but this utilization does not produce definite concentrations of artifacts except possibly at base camps. None of these were located. The vegetative cover inhibited 100 percent coverage of the parcels, but all feasible locations for occupation were intensively surveyed for a total of five man/days.

The one-page report closes by stating: "The areas surveyed appear to be devoid of any archeological material."

Also during the summer of 1975, Dr. Calvin Jennings of Colorado State University completed an archeological reconnaissance survey of proposed coal lease areas for the BLM. In accordance with their contract, only a portion of each lease was actually surveyed; areas having the greatest potential for site locations received the closest scrutiny. However the Jennings survey disclosed six sites in the immediate proposed action areas, two of which are on tracts which were to have been surveyed by Dr. Olson. Figure EII-20 indicates the locations of the sites and Table EII-13 indicates their nature.

TABLE EII-13

Cultural Resources at the Energy Fuels Mine Areas

	Nature of Site				
Site Number	Archeologic			Historic	Comments
	Lithic	Chipping Station	Campsite		
1			X		Site has been disturbed by a powerline and road.
2		X			Site disturbed by a dozer cut.
3	X				Road cut through site.
4			X		Site is disturbed by plowing.
					Recommended nomination to the National Register of Historic Places.
5			X		Site is disturbed by plowing. Recommended testing.
6			X		Site is disturbed by plowing.
7				X	3 milled lumber buildings, partially collapsing, and machinery.
8				X	Foidel School

No other cultural resources are known on or in close proximity to the three Energy mine areas.

Historical Resources

Figure EII-20 indicates the location of the only two known historic sites in the area, and Table EII-13 shows their nature. The site south of Pinnacle Peak is of relatively recent origin and is a farmstead of no special significance. The land on which the structures lie was first deeded by the U.S. Government on September 19, 1911 to Samuel Handley (Routt County Assessor's Office).

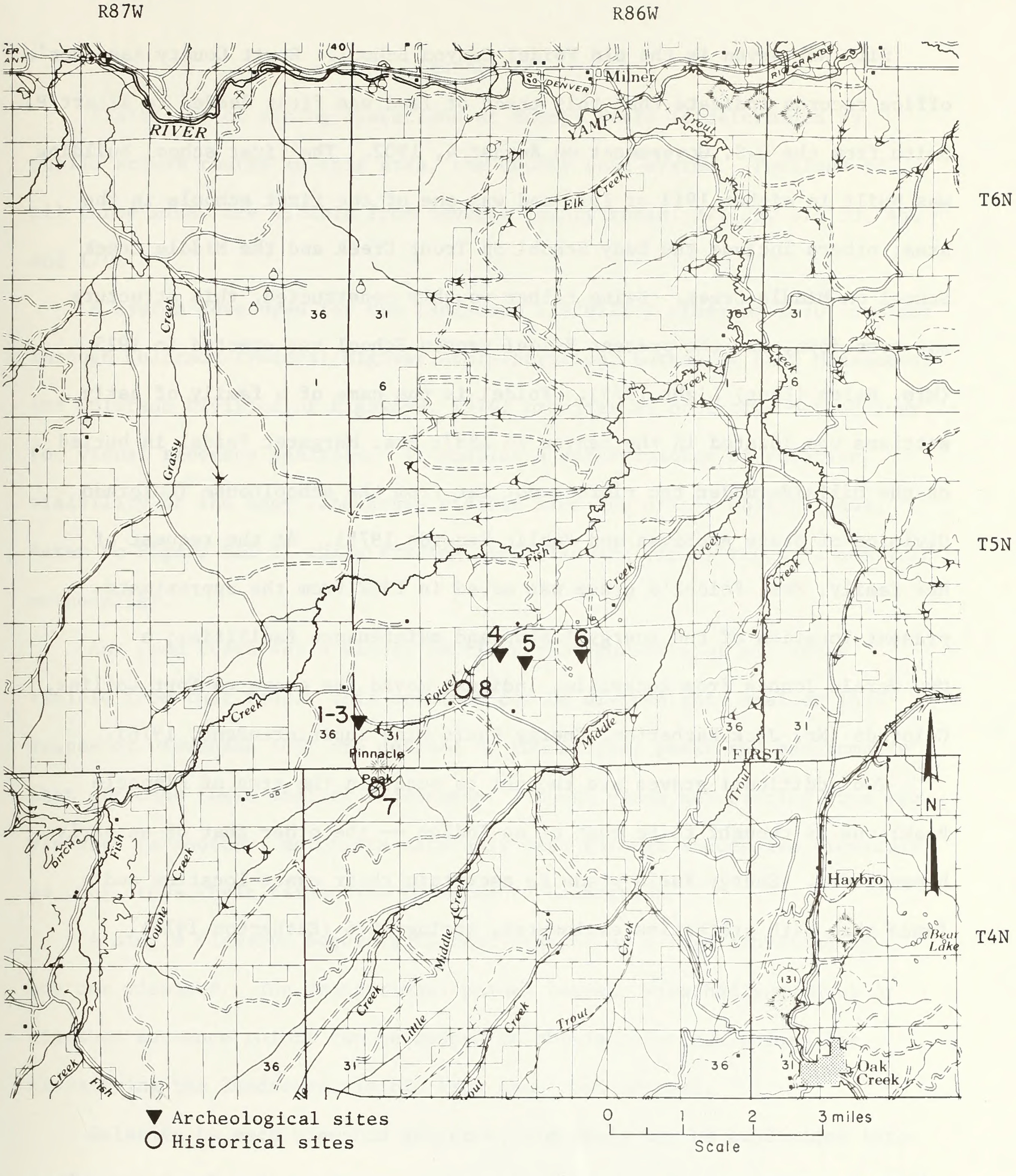


FIGURE EII-20

Cultural resources at the Energy Fuels mine areas.

Site No. seven is the old Foidel Canyon School. Routt County Assessor's office records indicate that this tract of land was first deeded to Albert P. Smith from the U.S. Government on August 4, 1902. The first school building was built in either 1913 or 1914 and was one of the first schools in the area; others include the Eddy School on Trout Creek and the Middle Creek School on Middle Creek. Being rather roughly constructed, this structure was torn down, and the present Foidel Canyon School was erected in 1925 (Mrs. Helen (Long) Light 1975). Foidel is the name of a family of early settlers who located in the canyon in 1887; Mrs. Margaret Foidel is buried on the hillside under the rimrock not far from the schoolhouse (Colorado Division of State Archives and Public Records 1975). At the request of her family, Mrs. Foidel's grave was moved in 1962 from the approximate present location of the Energy 1 shop and maintenance facilities; a Mr. Gerald Jonnes from Rockville, Indiana, moved the grave to Fort Collins, Colorado (Mr. Jack Eatherton, Energy Fuels Mine Superintendent, 1976).

Two additional graves are thought to occur in the area of Pinnacle Peak; one is thought to be that of an Indian -- the other that of an early homesteader. Energy Fuels plans to ascertain their exact location and fence them with protective exclosures, spring 1976 (Eatherton 1976).

Aesthetics

Visibility of mining operations at Energy Fuels is determined by public access routes in this area, the county road system. Portions of all three mines are visible from several county roads: 27, 29, 31, 33, 43, and 179.

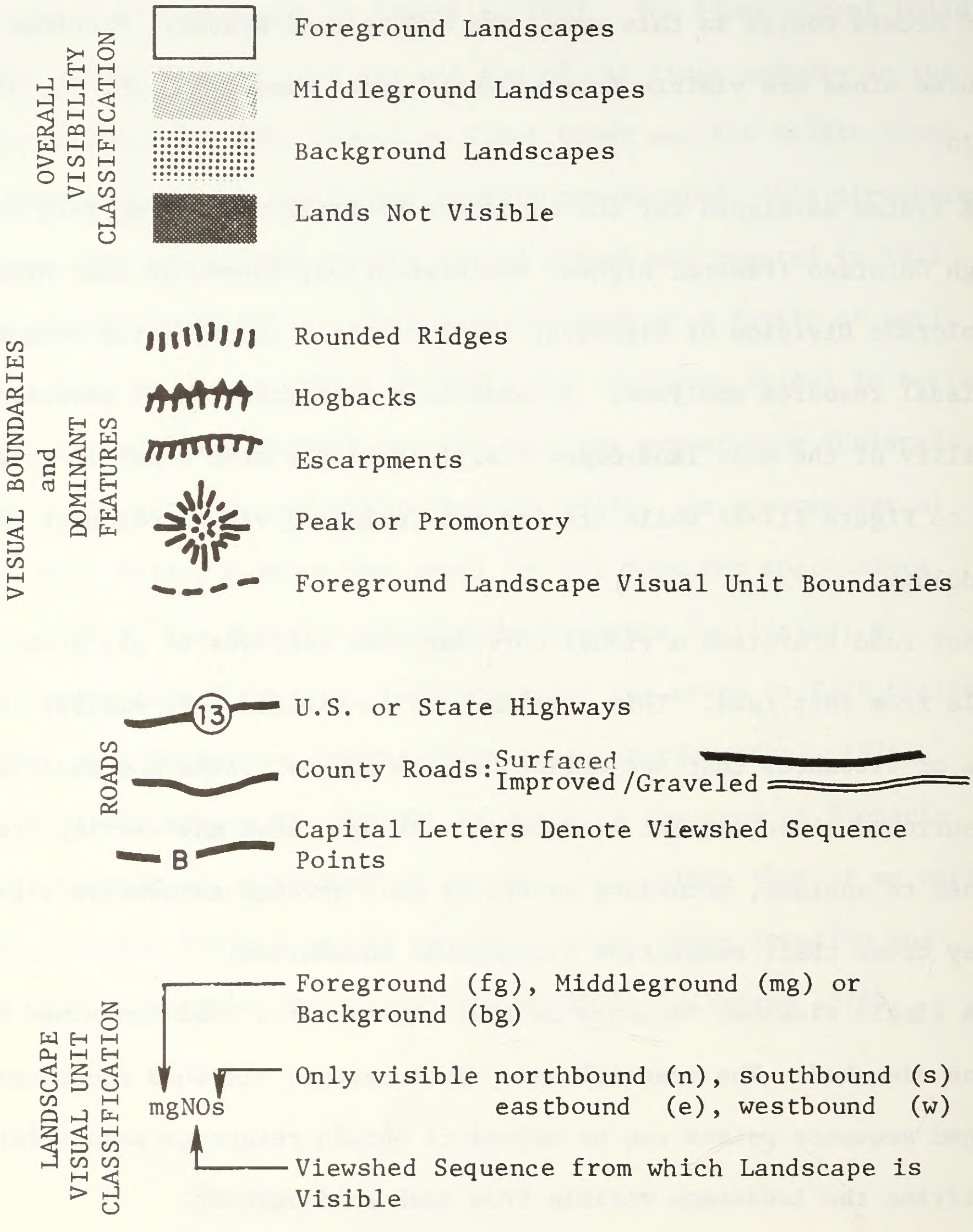
A system developed for the Landscape Visibility study on I-70 corridor through Colorado (Federal Highway Administration, Bureau of Land Management and Colorado Division of Highways, 1974) provides an objective methodology for visual resource analyses. It enables a determination of relative visibility of the many landscapes visible from the area's public roads. Refer to Figure EII-21 while tracing the following visual resource analysis methodology.

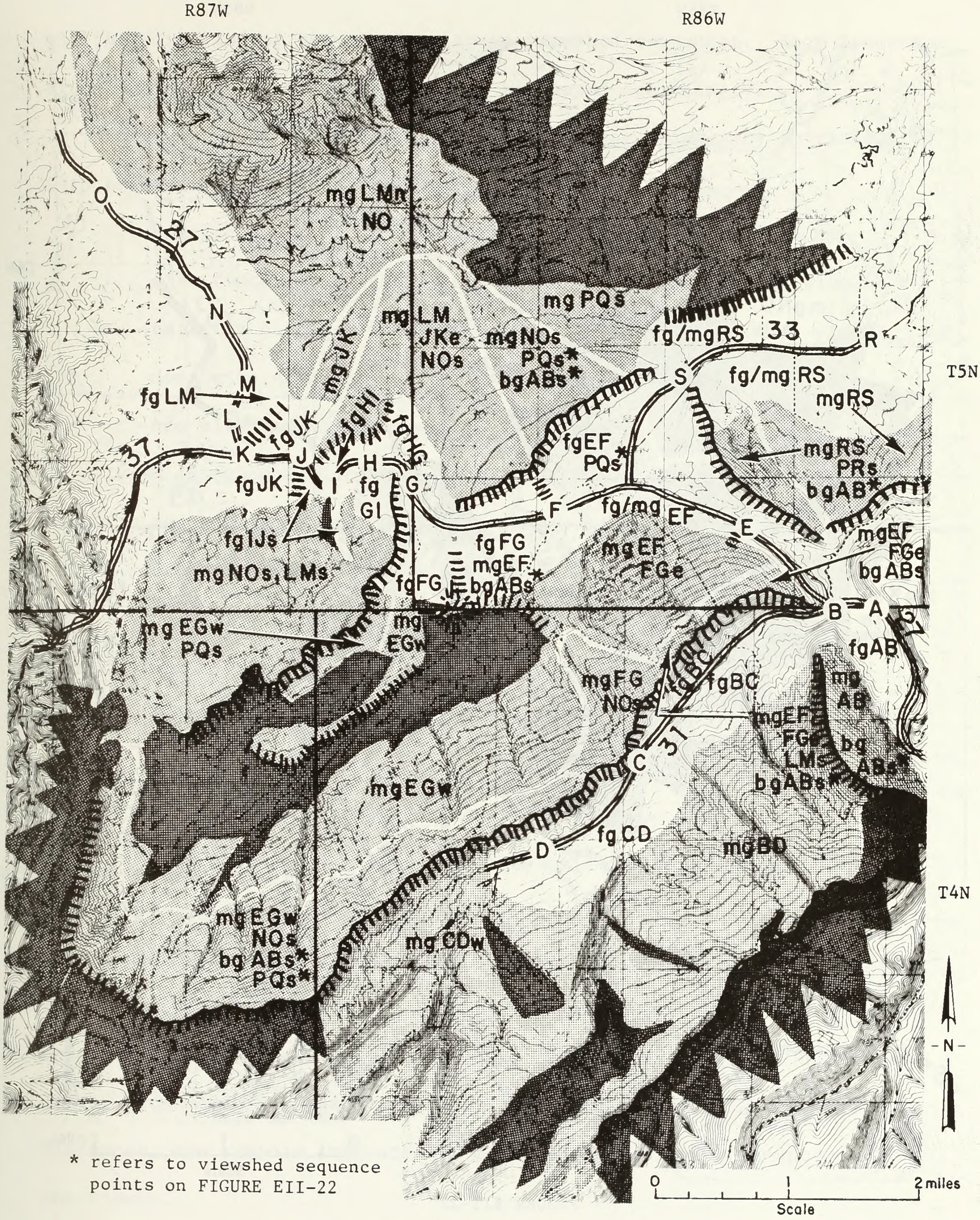
Any road traverses a visual corridor that consists of all areas visible from that road. This corridor can be divided into smaller landscapes or viewsheds that are defined by the ridges, peaks and escarpments that surround these smaller landscapes. Though views may overlap from one viewshed to another, motorists naturally pass through successive viewsheds as they cross their respective topographic boundaries.

A single viewshed sequence is that segment of a road contained by any one viewshed. The transitional points between viewshed sequences or viewshed sequence points can be mapped to obtain reference points for classifying the landscape visible from each road segment.

Relative to each viewshed sequence, viewsheds may be subdivided into landscape visual units; these are determined by: (1) their distance from the viewer, (2) the combinations of viewshed sequences offering the view and

LEGEND
for
LANDSCAPE VISIBILITY MAPS


OVERALL VISIBILITY CLASSIFICATION
Foreground Landscapes
Middleground Landscapes
Background Landscapes
Lands Not Visible
VISUAL BOUNDARIES and DOMINANT FEATURES
Rounded Ridges
Hogbacks
Escarpments
Peak or Promontory
Foreground Landscape Visual Unit Boundaries
ROADS
13
U.S. or State Highways
County Roads: Surfaced
Improved /Graveled
B
Capital Letters Denote Viewshed Sequence Points
LANDSCAPE VISUAL UNIT CLASSIFICATION
Foreground (fg), Middleground (mg) or Background (bg)
Only visible northbound (n), southbound (s) eastbound (e), westbound (w)
mgNOs
Viewshed Sequence from which Landscape is Visible



* refers to viewshed sequence points on FIGURE EII-22

FIGURE EII-21

Landscape visibility map of Energy Fuels 1 and 2.

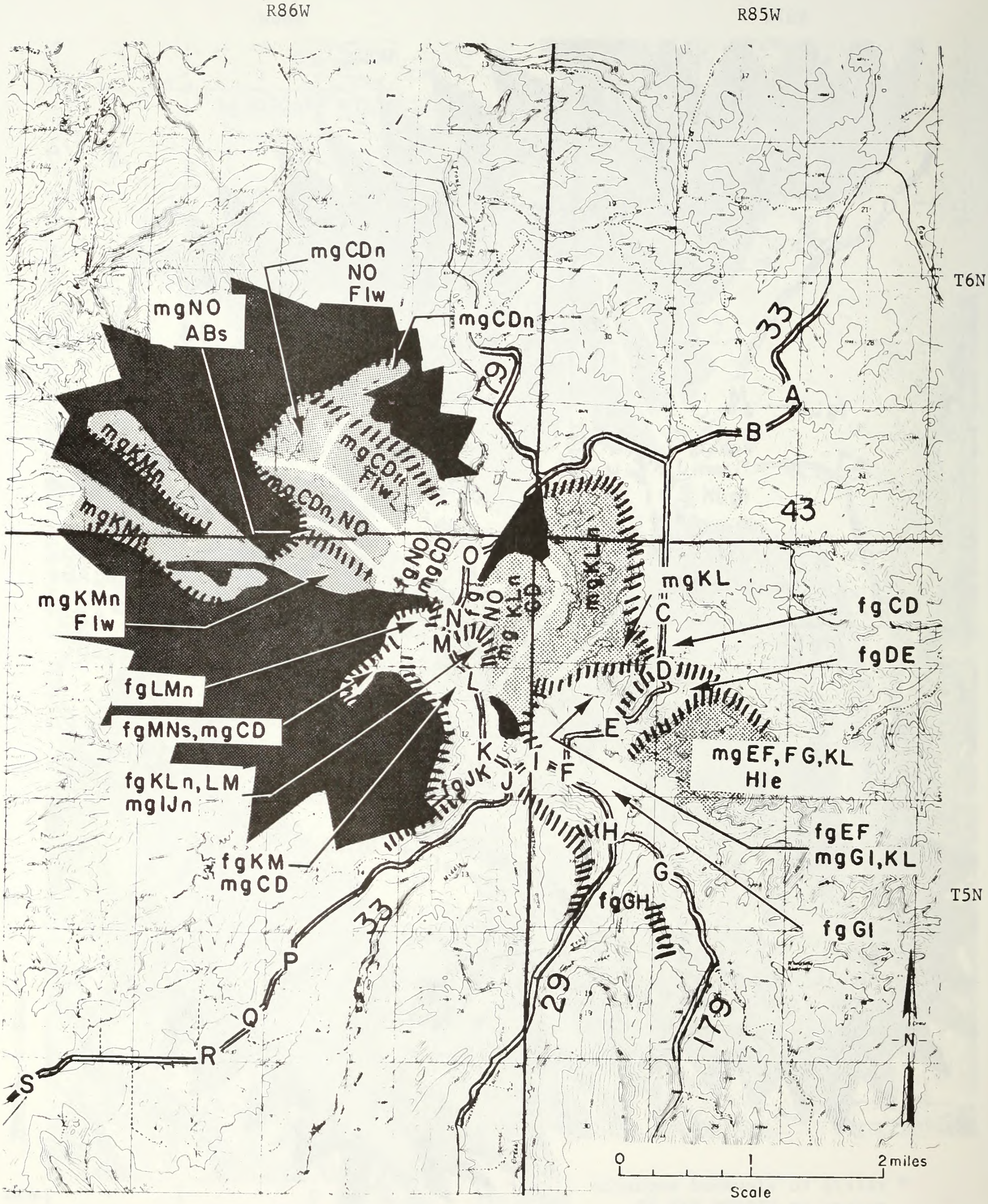


FIGURE EII-22

Landscape visibility map of Energy Fuels 3.

(3) the direction of travel along these viewshed sequences. Each landscape visual unit's relative visibility may be mapped accordingly.

Borrowing from the art of landscape painting, views may be classified into three picture planes or distance zones:

1. Foregrounds include that portion of the view wherein human-size features are easily discernable, as are the four visual building blocks - form, line, color, and texture (i.e. visual dominance elements). They generally lie from one-quarter - one mile beyond the viewer.
2. Middlegrounds include larger-scale landscapes, such as the three-dimensional quality of landforms and the patterns of cloud shadows. Overall patterns of vegetation and earth constitute texture which is no longer distinguishable in human-size features. Middlegrounds generally occur from the foreground limit up to three-eight miles distant.
3. Backgrounds include distant landscapes where colors and texture are subdued. These landscapes often appear as silhouettes, although some vegetative and geologic patterns are visible up to 20 miles.

Landscape visibility maps for the three Energy mine areas are found in Figures EII-21 and EII-22. Mapping symbols identify each visual unit's relative visibility as indicated above. Though any one visual unit may be viewed from more than one viewshed sequence and therefore at varying distances, map symbols indicate its most sensitive level of exposure to the viewer.

Analysis of the landscape visibility maps will suggest areas that are more visible than others. Visibility increases at closer distances, when both number and length of viewshed sequences offering the view increase, and when the units can be viewed by motorists traveling in both directions.

Refer to Chapter IV of the Regional Analysis for a discussion of the regional aesthetic setting of Energy Mine as well as a general discussion of visual resources.

Energy 1

Energy 1 is confined largely to the immediate landscape of Foidel Creek downstream to the break in rimrock escarpments that lie above the Foidel School. However overburden has been dumped over a rock escarpment into Middle Creek creating foreground talus slopes that do not conform with the form, line, color, and texture (visual dominance elements) of the landscape adjacent to Routt County Road 31. Both foreground and middleground visual units containing this escarpment may be viewed from viewshed sequence CD. This area contains portions of competitive lease applications C-9968 and C-22644 and existing lease C-081330 (see Figure EII-23)

Ten additional Figures, EII-23 through EII-32, are photographs of the more significant views from public roads at Energy 1; they are helpful in indicating the relative visibility of the proposed action area.

The most visually sensitive portion of Energy 1 is the foreground visible from viewshed sequence EG. This landscape contains all base facilities for the mine; both old and new tipples, shop, railroad siding, and transmission lines are large-scale features that dominate this landscape.

They do not borrow visual dominance elements (i.e. form, line, color, and texture) from the adjacent landscape, and therefore are minus deviations (visual intrusions) from the characteristic landscape (see Regional Analysis, Chapter IV). Construction of the newly relocated Routt County Road 27 has improved visibility of the base facilities by increasing the viewing angle through elevation of the roadway. The alinement of the railroad siding helps to focus attention on the shop area as motorists cross the railroad overpass. Pinnacle Peak, a dominant natural feature in this visual unit, is the immediate background for the new tipple and thus attracts attention to it, as does its silver-colored, strongly line-dominant form (see Figures EII-24, EII-28, and EII-25).

Viewshed sequence BE provides visual access to a foreground visual unit that contains competitive lease application C-16284 and one unit of C-22677. Few deviations presently occur in this landscape (see Figure EII-26).

Another unit of competitive lease application C-22677 occupies the foreground landscape of viewshed sequence RS; this visual unit is alfalfa cropland and lies at a low viewing angle to RS. It is intersected by two wooden pole transmission lines, one a 230-kv Colorado Ute line and the other a 138-kv Tri-State; both are strongly line-dominant minus deviations (see Figure EII-27).

The middleground landscape at Energy 1 contains all existing overburden and coal stripping areas. Viewing angle is small, and therefore the size of the middleground "picture plane" is much smaller than the actual disturbed area. However this landscape dominates the middleground visual unit in which it occurs. Mine spoils are alined perpendicular to the contour, and appear as vertical ridges which occupy much of the mined-over area, but an increasingly large area is being reshaped to remove these strongly line-dominant minus deviations. Ridgetop mining operations are strongly form and line-dominant as they are silhouetted against the sky from viewshed sequences EF and FG (see Figure EII-28).

Remainder of the middleground landscape at Energy 1 lies beyond Pinnacle Peak and is partly obscured by it. It contains nearly all of existing lease C-081330 and competitive lease applications C-9968 and C-22644 and contains no readily observable deviations from the characteristic landscape (see Figure EII-29).

Upper reaches of the middleground landscape lying adjacent to viewshed sequence EG are also visible from more distant viewshed sequences. In some cases this foreground is also background for viewshed sequence AB (see Figure EII-30).

Energy 2

Due to a precipitous rimrock ledge on its southern perimeter, Energy 2 is only visible from viewshed sequences lying along Routt County Roads 27 and 33, not from Energy 1 area.

Figures EII-33 through EII-35 are photographs of the more significant views obtainable from public roads at Energy 2.

Most visually sensitive areas at Energy 2 are the foreground visual units that lie adjacent to viewshed sequences RS, GH, and JK. Currently only mined-out areas that are under various stages of reclamation occupy viewshed sequences GH and JK; however, these landscapes generally lie at a low angle and are therefore less visible (see Figure EII-33).

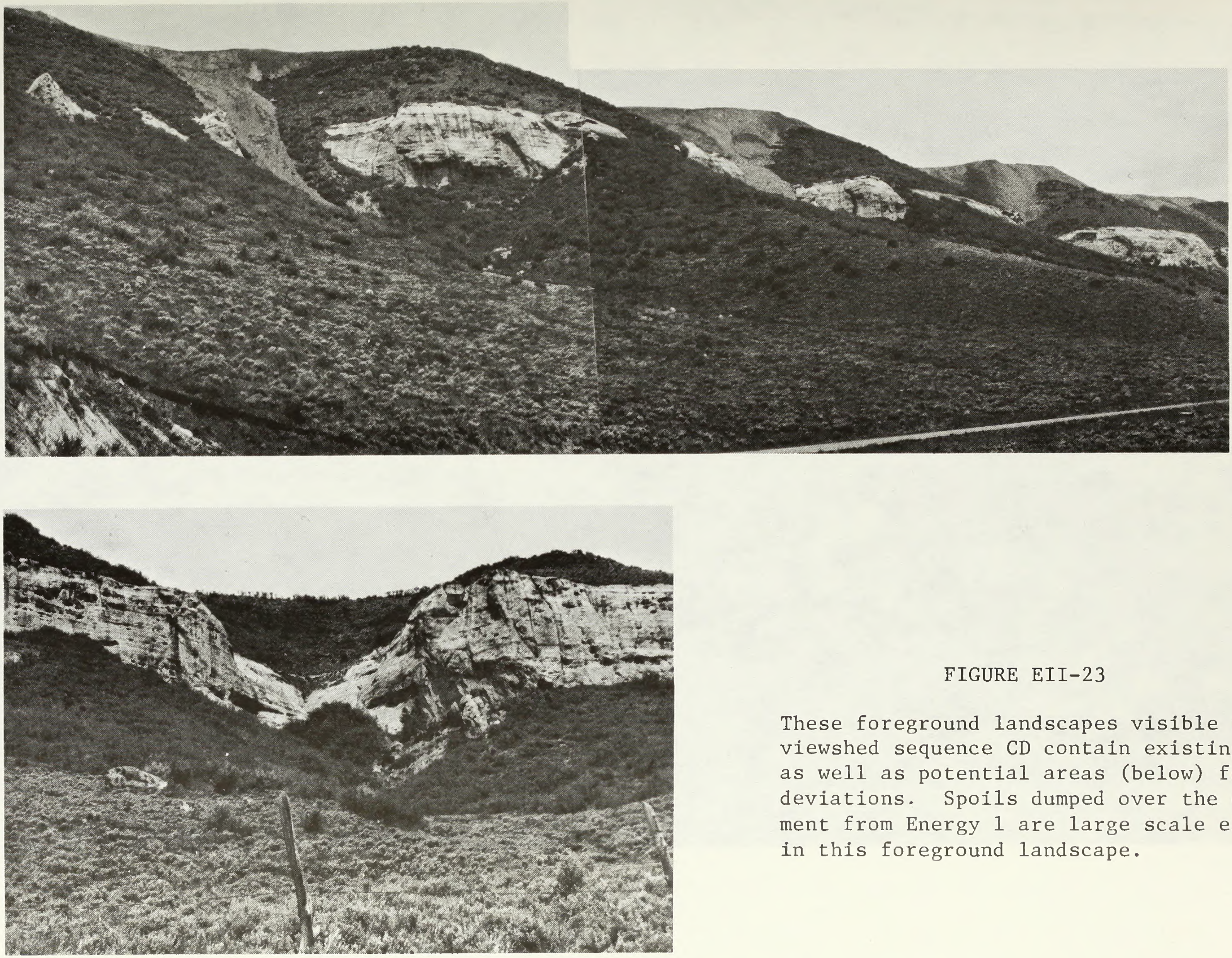


FIGURE EII-23

These foreground landscapes visible from viewshed sequence CD contain existing (above) as well as potential areas (below) for minus deviations. Spoils dumped over the escarpment from Energy 1 are large scale elements in this foreground landscape.

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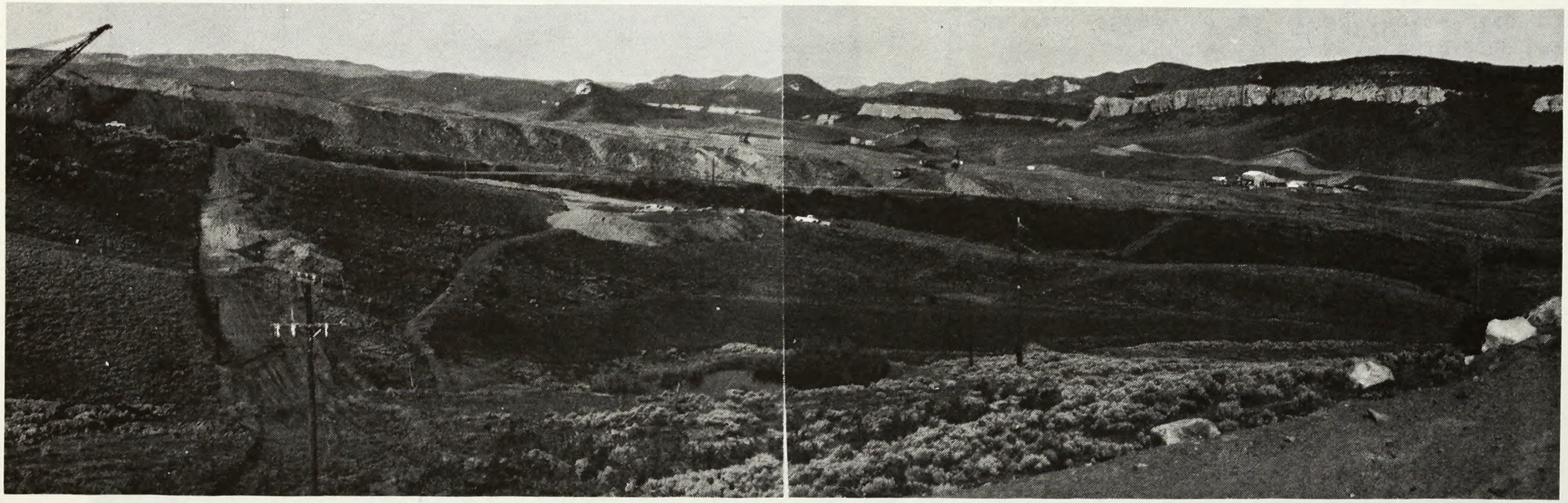

FIGURE EII-24

The entire operation at Energy 1 becomes visible immediately upon entering viewshed EF while traveling westbound on County Road 27. The newly relocated 69-kv transmission line is visible in the foreground.

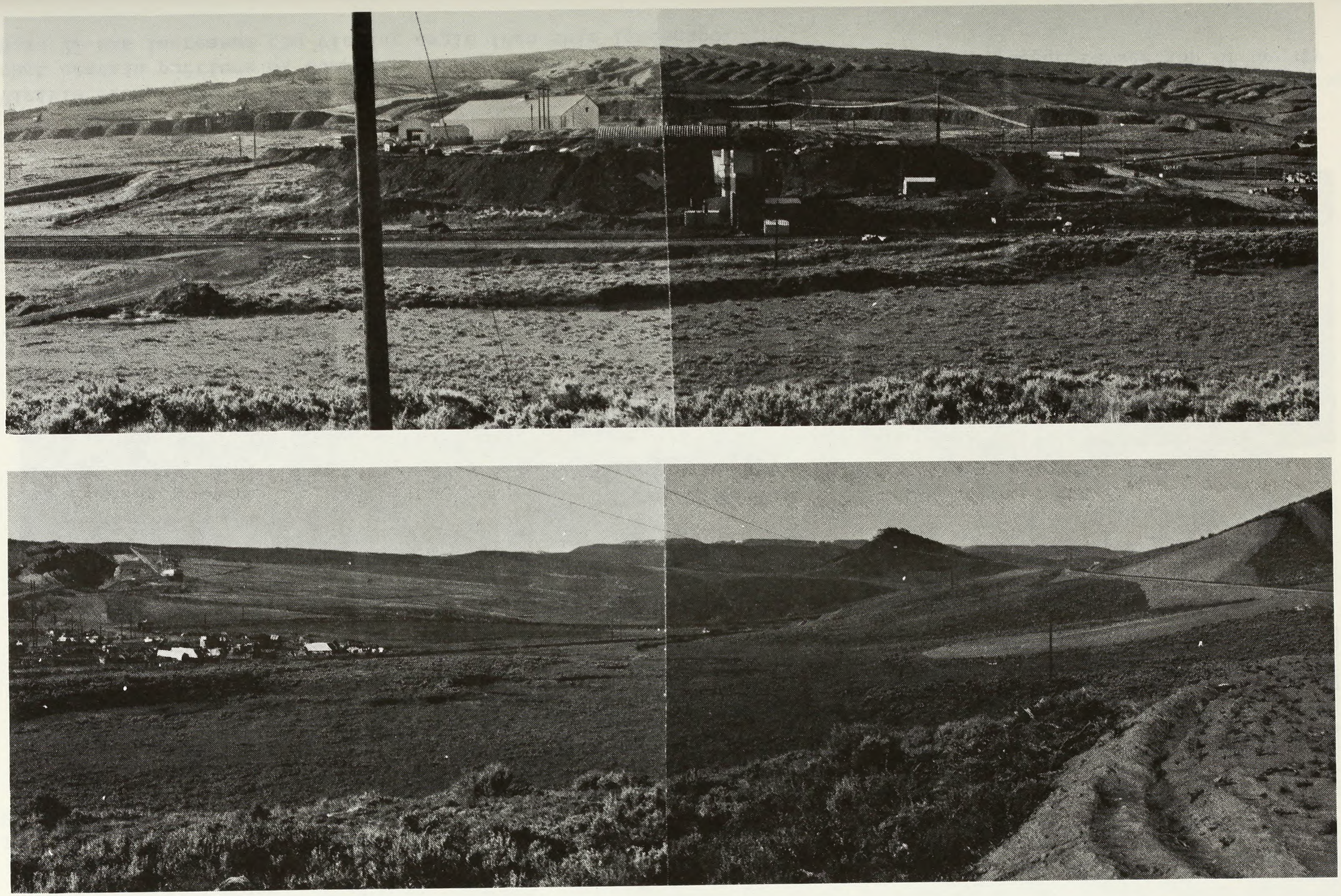

FIGURE EII-25

This four-shot panorama from viewshed sequence EF shows both active pits and the old mined-over area (above) plus the area of the proposed action visible to the left of Pinnacle Peak (below). The Energy 1 shop and old tipple are visible in the foreground.

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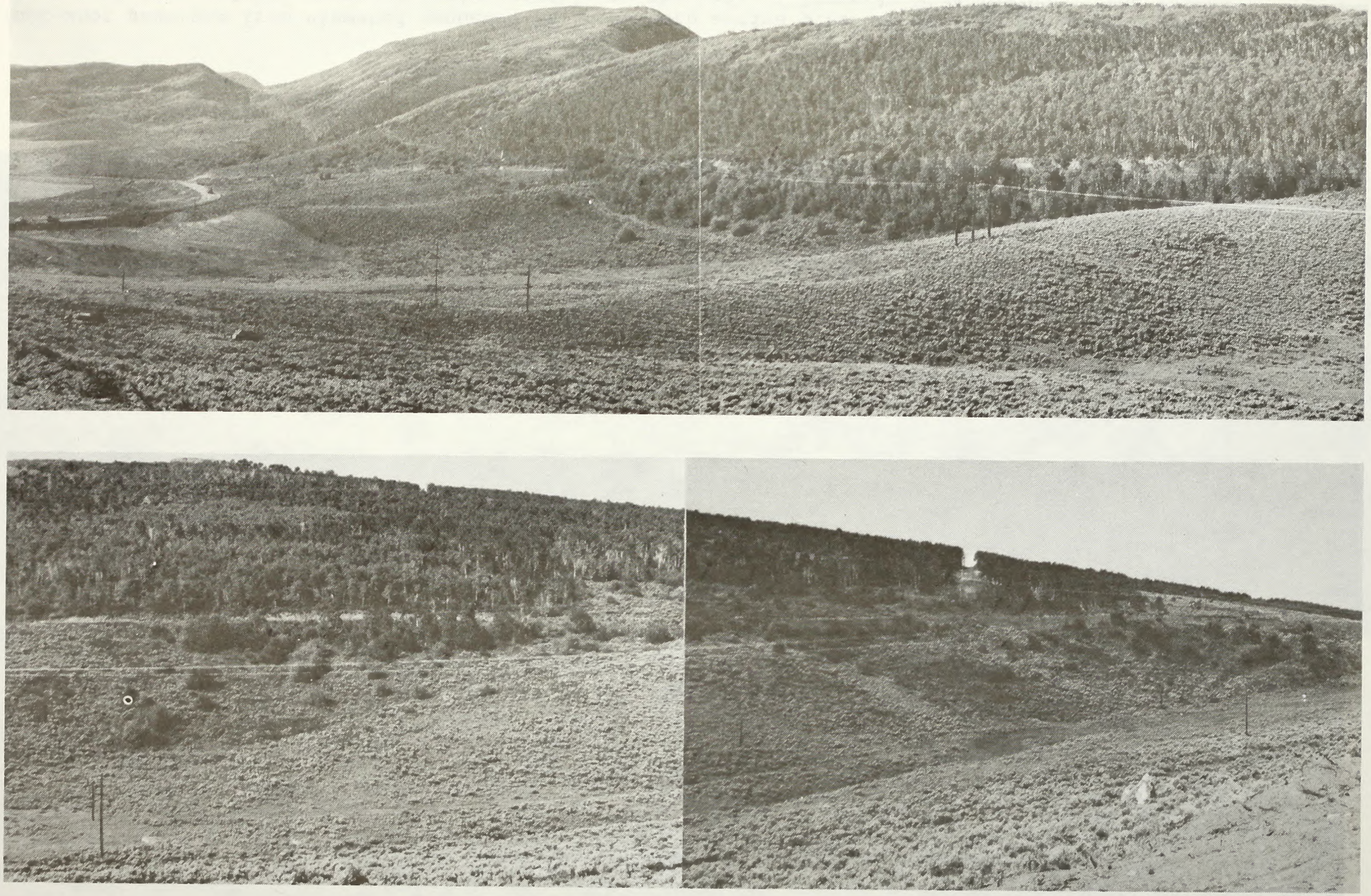

FIGURE EII-26

Visible from viewshed sequence BE, this four-shot panorama displays mixed foreground and middleground landscapes that contain portions of Competitive Lease Application C-16284 and C-22677. The recent relocation of County Road 27 has increased the viewing angle into this landscape.

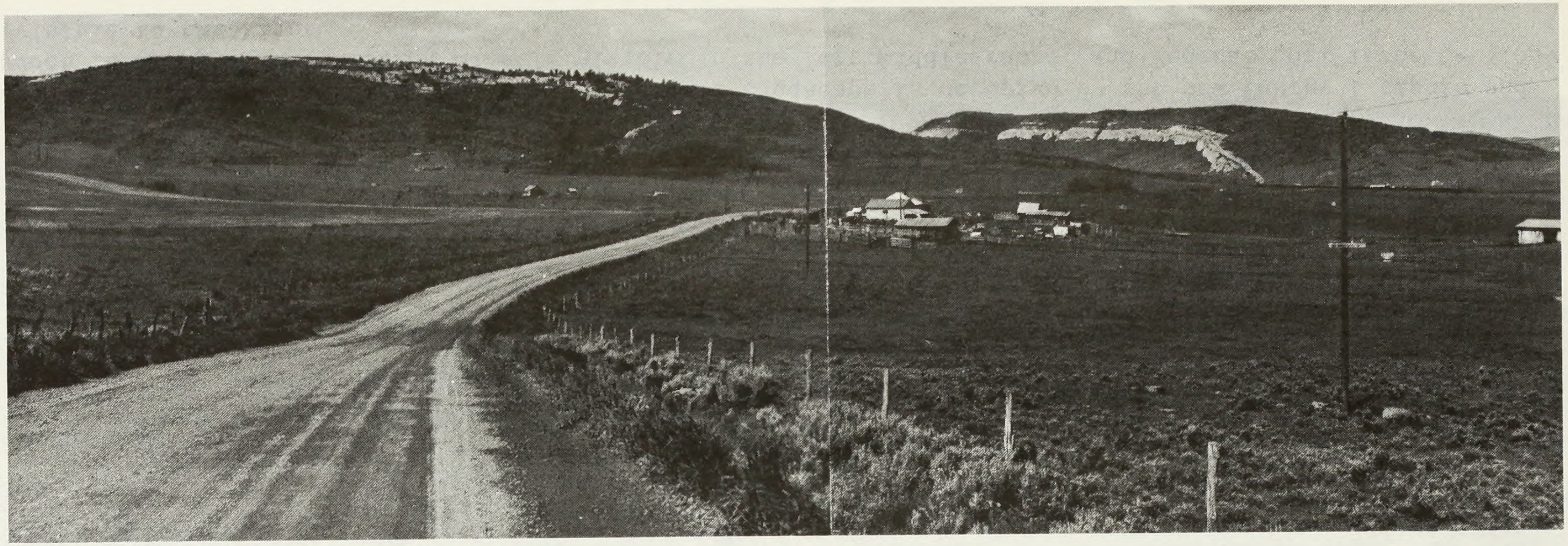

FIGURE EII-27

Southbound motorists on viewshed sequence RS, County Road 33, can view this portion of competitive lease C-22677 in the foreground landscape.

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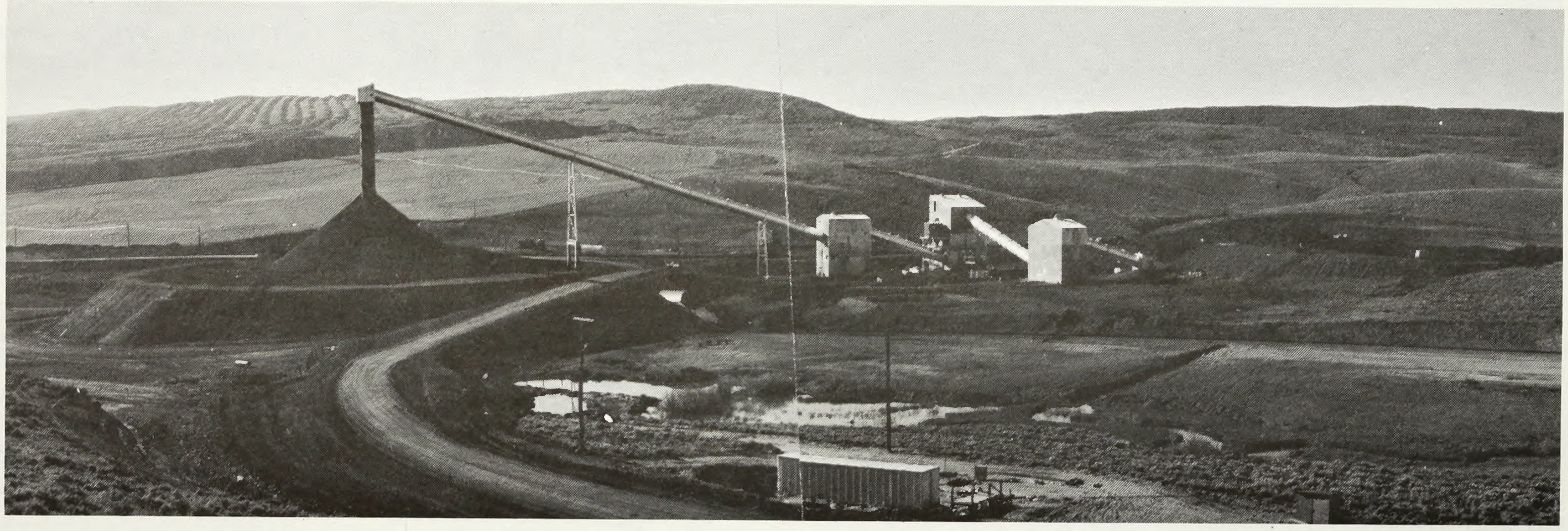

FIGURE EII-28

Visible from viewshed sequence FG, this foreground landscape is occupied by the new Energy 1 tipple and loadout facility. The existing mine is visible in the left middleground, and Federal coal lease C-081330 is visible to the right.

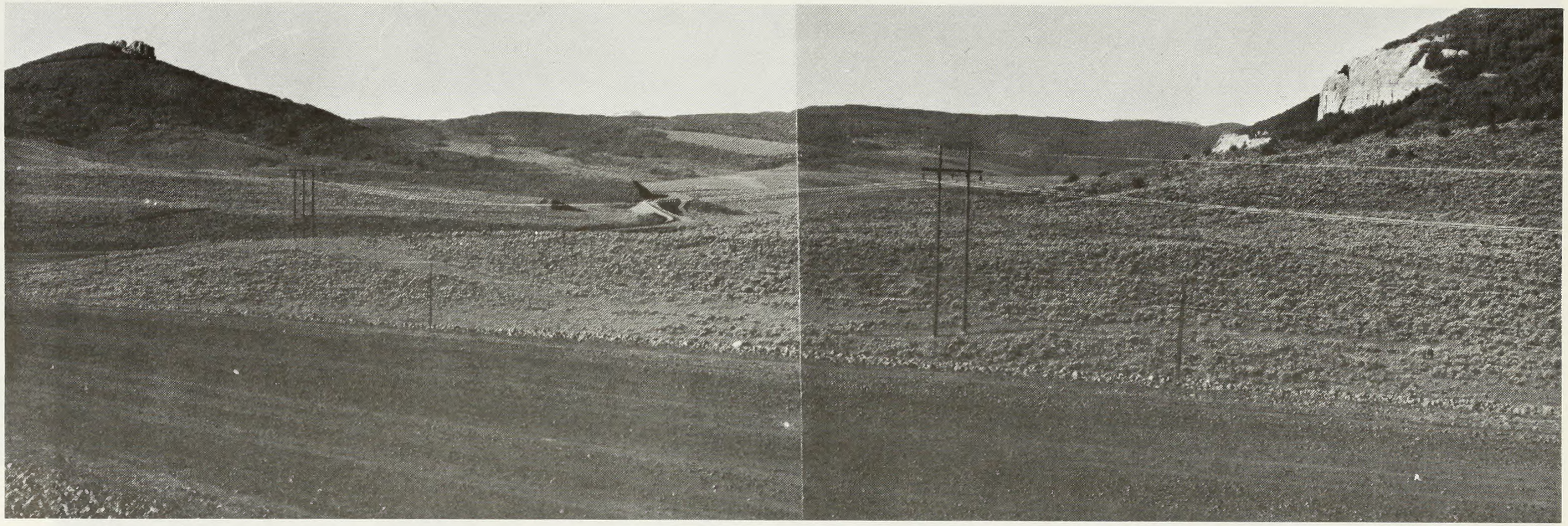

FIGURE EII-29

Immediately upon entering the Energy 1 area from the west, this view appears on viewshed sequence FG. Beyond the Energy 1 rail spur lies competitive lease applications C-22644 and C-9968.

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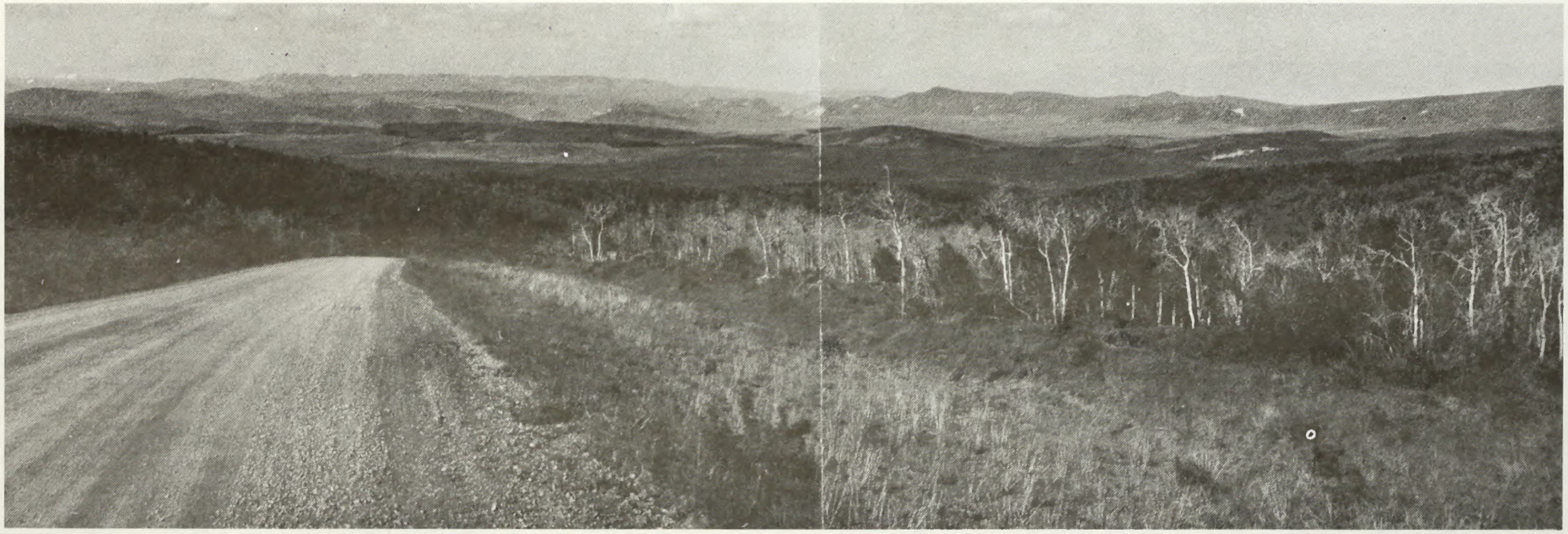

FIGURE EII-30

This panorama may be viewed looking southwest from viewshed sequence AB, on County Road 33. Scanning from left to right, portions of Energy 1, Pinnacle Peak, portions of Energy 2 and part of competitive lease application C-22676 at the Energy 3 area occur as both middleground and background landscapes.

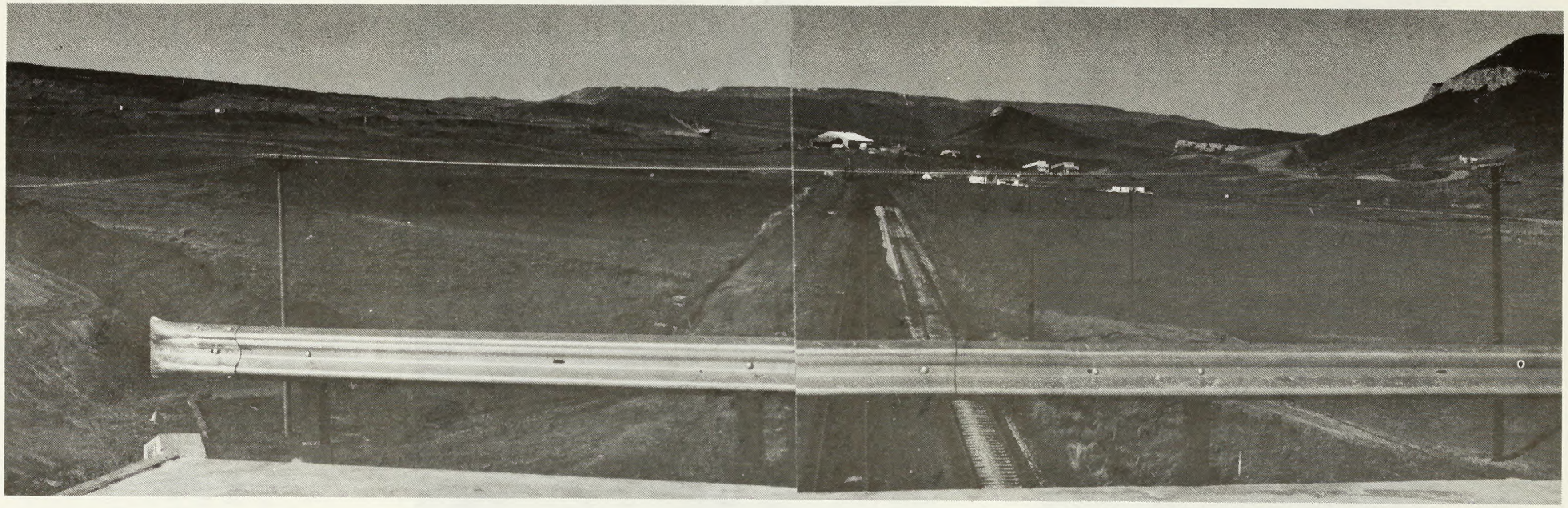

FIGURE EII-31

This axis or alinement of the railroad siding helps to focus attention on the Energy 1 shop area as viewed from the railroad overpass, viewshed sequence EF, County Road 27. Portions of competitive lease applications C-9968 and C-22644 plus Federal coal lease C-081330 are visible as middleground beyond the shop area.

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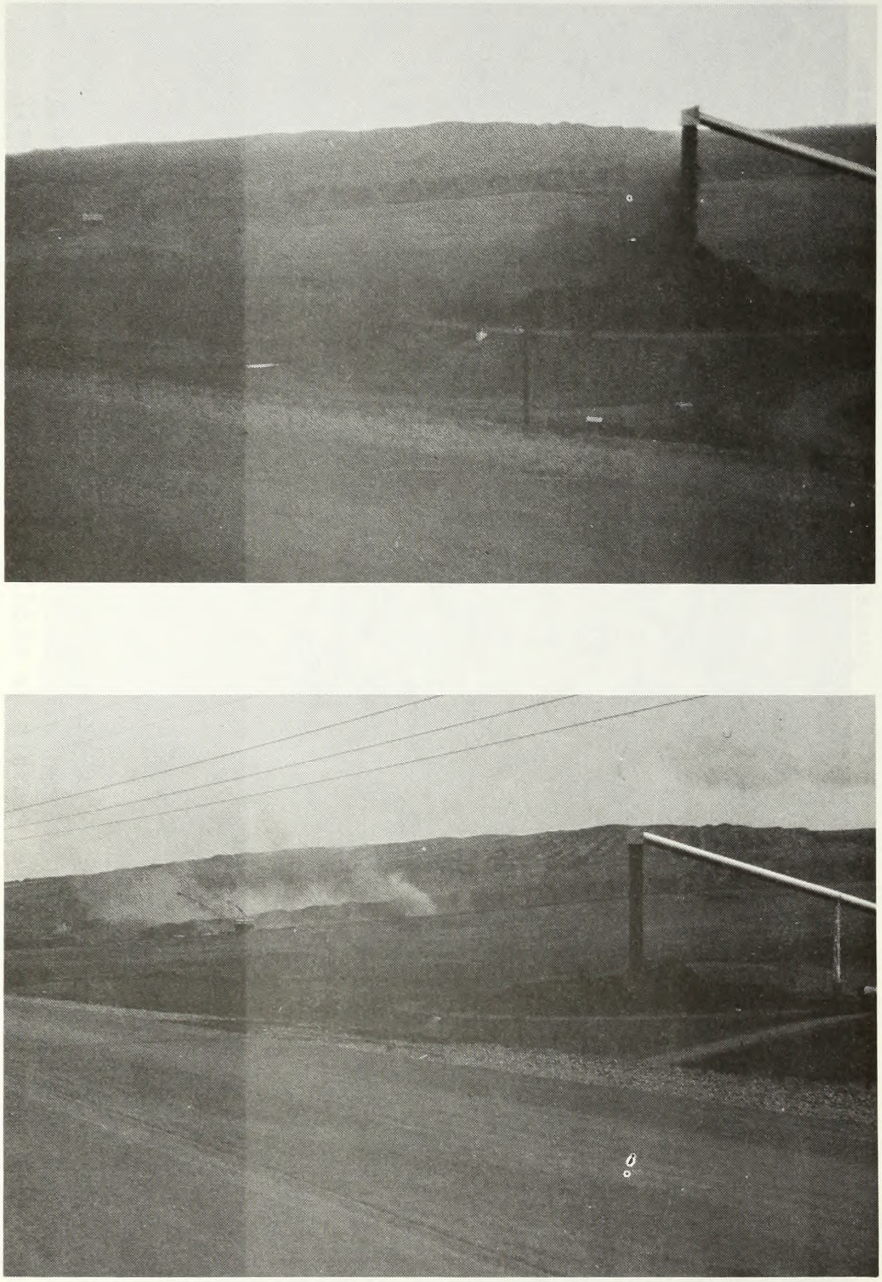

FIGURE EII-32

Examples of short-lived minus deviations include blowing coal dust from the Energy 1 tipple (above) and dust clouds resulting from blasting (below) as seen from viewshed sequence FG on County Road 27.

Middleground landscape visual units along County Road 27 reveal the greatest portion of Energy 2 mine. Strike-mining at this mine generally precludes viewing parallel to mine spoils, and therefore the strongly line-dominant effect of mining across contours is absent; reshaping spoils soon after mining also helps minimize these minus deviations. The greatest minus deviations at Energy 2 are due to strongly line-dominant roads, and to form and color-dominant mined-over areas. However, all middleground visual units also lie at a low angle which reduces their visibility. Viewshed sequence NO offers the greatest viewing angle for the largest portion of the Energy 2 viewshed.

Viewshed sequences LM and NO also provide visual access to middleground landscape units containing existing leases C-20900 and C-0128433, and a unit of competitive lease application C-22677 (see Figures EII-34 and EII-35). Only a small wedge of the Energy 2 area is visible as background; most of this visual unit lies between leases C-0128433 and C-081330.

Energy 3

Viewsheds occupied by Energy 3 may be viewed from several county roads (see Figure EII-22). Two landscape visual units contain portions of the existing mine that may be viewed from viewshed sequences LM and NO. Figures EII-36 through EII-38 show significant views from county roads in the Energy 3 area.

Most visually sensitive area at Energy 3 is the foreground landscape adjacent to County Roads 29, 33, and 179. At the present stage of development, the foreground visual unit adjacent to viewshed LM contains the area of overburden and coal removal, plus an adjacent area of coal exploration

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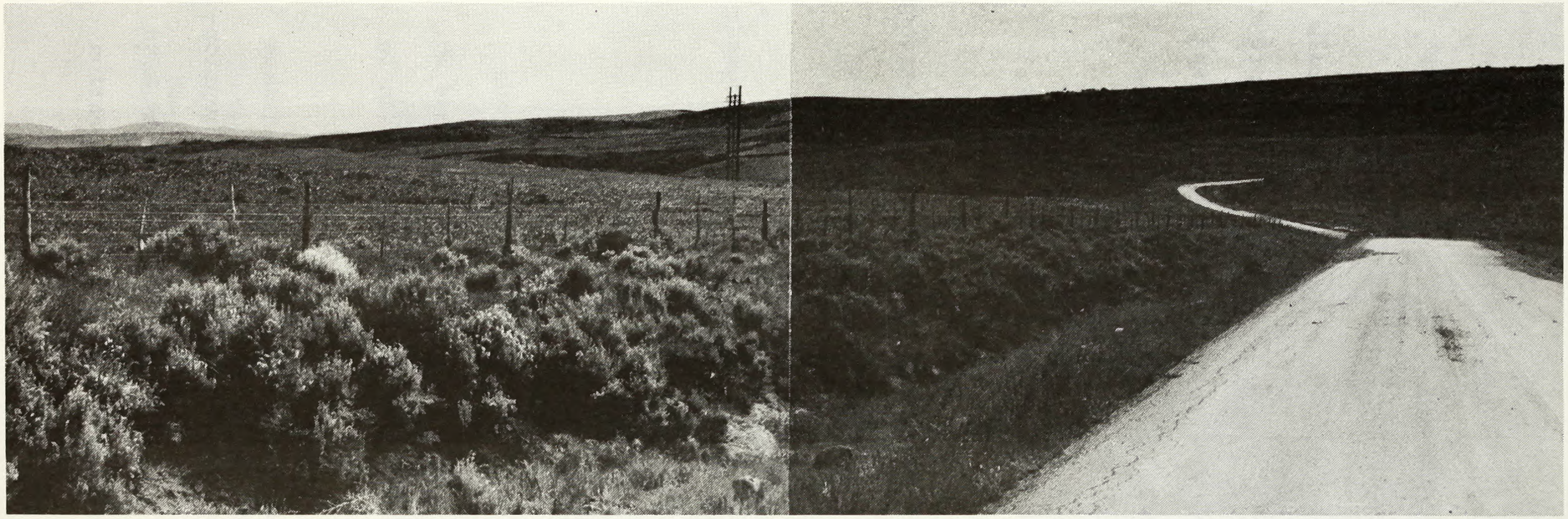

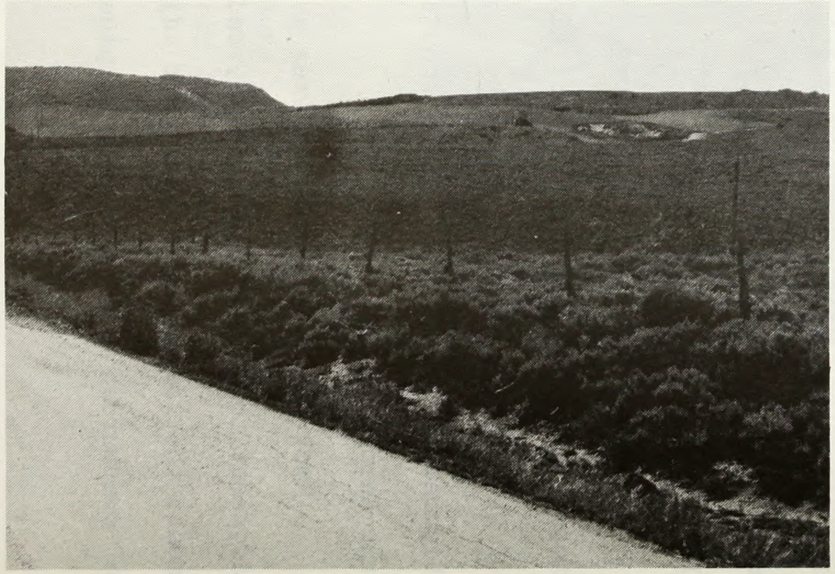

FIGURE EII-33

Eastbound travelers on County Road 27 look directly at Energy 2 in mixed foreground and middleground landscapes (above). The slope immediately behind the point where the road disappears from view has been reshaped and revegetated.

The last photo of this three-shot panorama (see left) shows portions of competitive lease application C-22677.

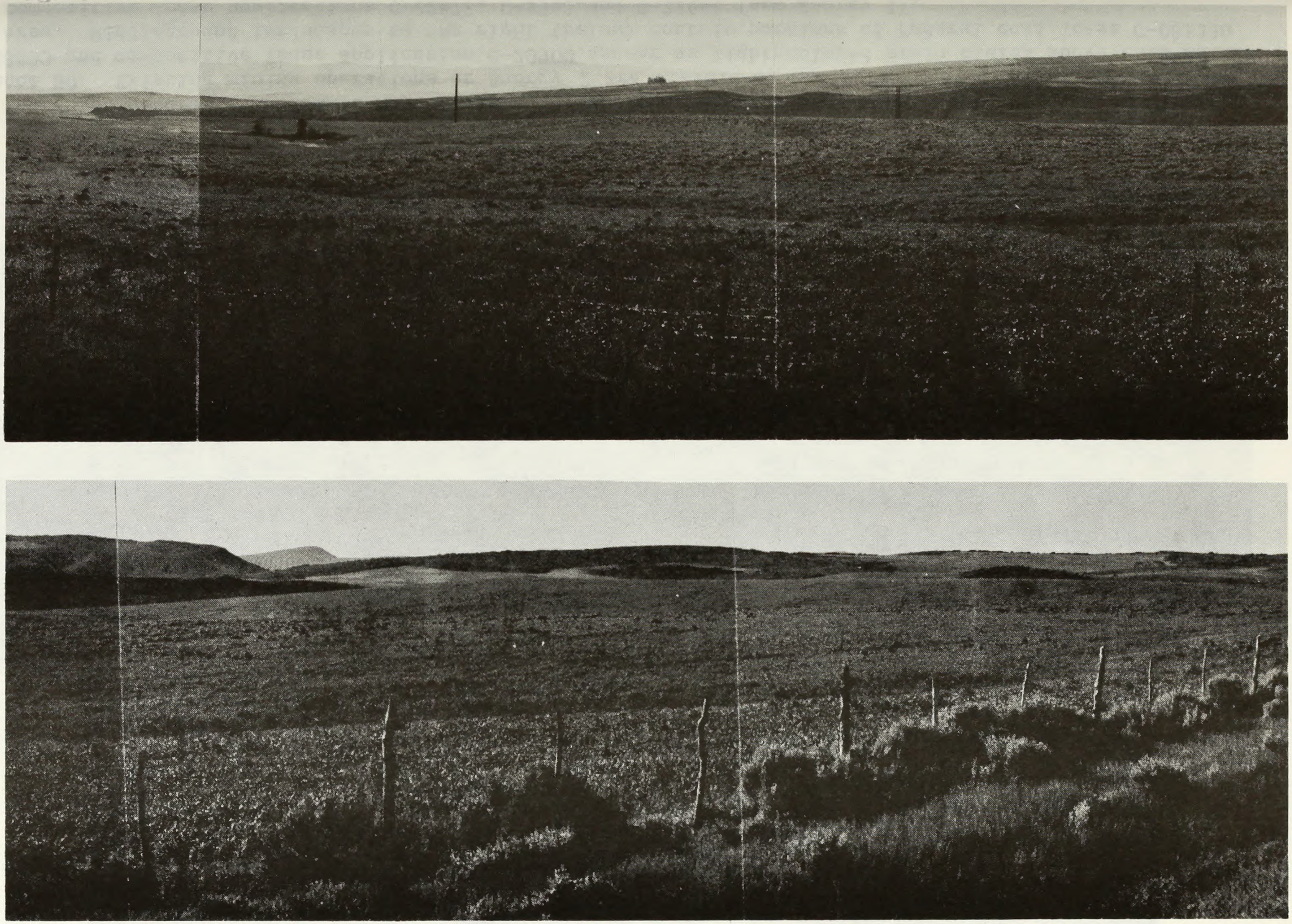

FIGURE EII-34

This four-shot panorama scans to the east from viewshed sequence LM on County Road 27. Existing Energy 2 operations plus Federal coal lease C-0128433 and competitive lease application C-20900 are visible to the left (above and part of lower photo). Competitive lease application C-22677 lies just below the horizons on the right (below). Note the Energy 1 spoils visible at the left of the lower photo.

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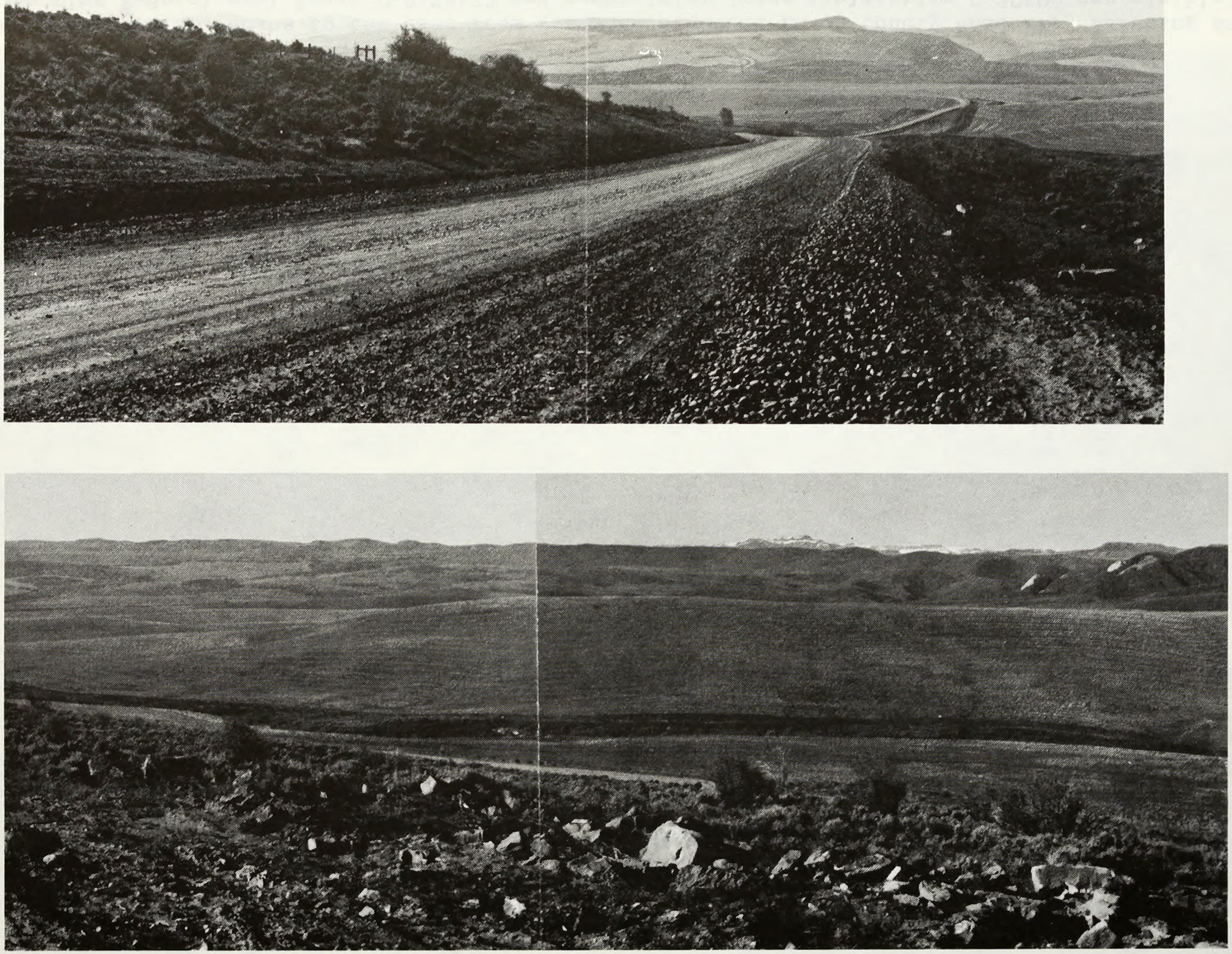

FIGURE EII-35

This four-shot panoramic landscape may be viewed by southbound motorists along County Road 27 on viewshed sequence NO. Existing mining operations at Energy 2 are visible on the left (above). Federal coal lease C-0128433 and competitive lease application C-20900 appear as light-colored grain fields above this mined-over area. Middleground landscapes to the right (below) contain portions of Federal coal lease C-081330 plus competitive lease applications C-22677, C-9968, and C-22644 (see Energy 1).

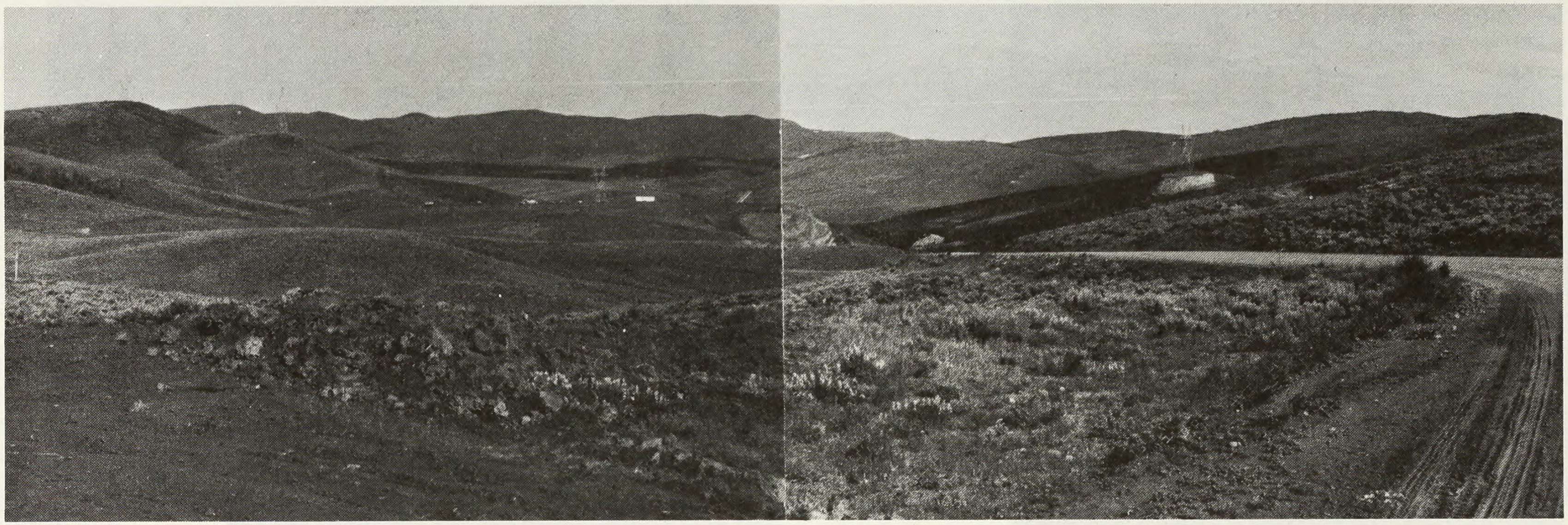

FIGURE EII-36

This two-shot panorama looks west into the active Energy 3 mine area from viewshed sequence LM. The large rounding ridge lying directly beyond the left edge of the exposed coal seam contains one area of competitive lease application C-22676.

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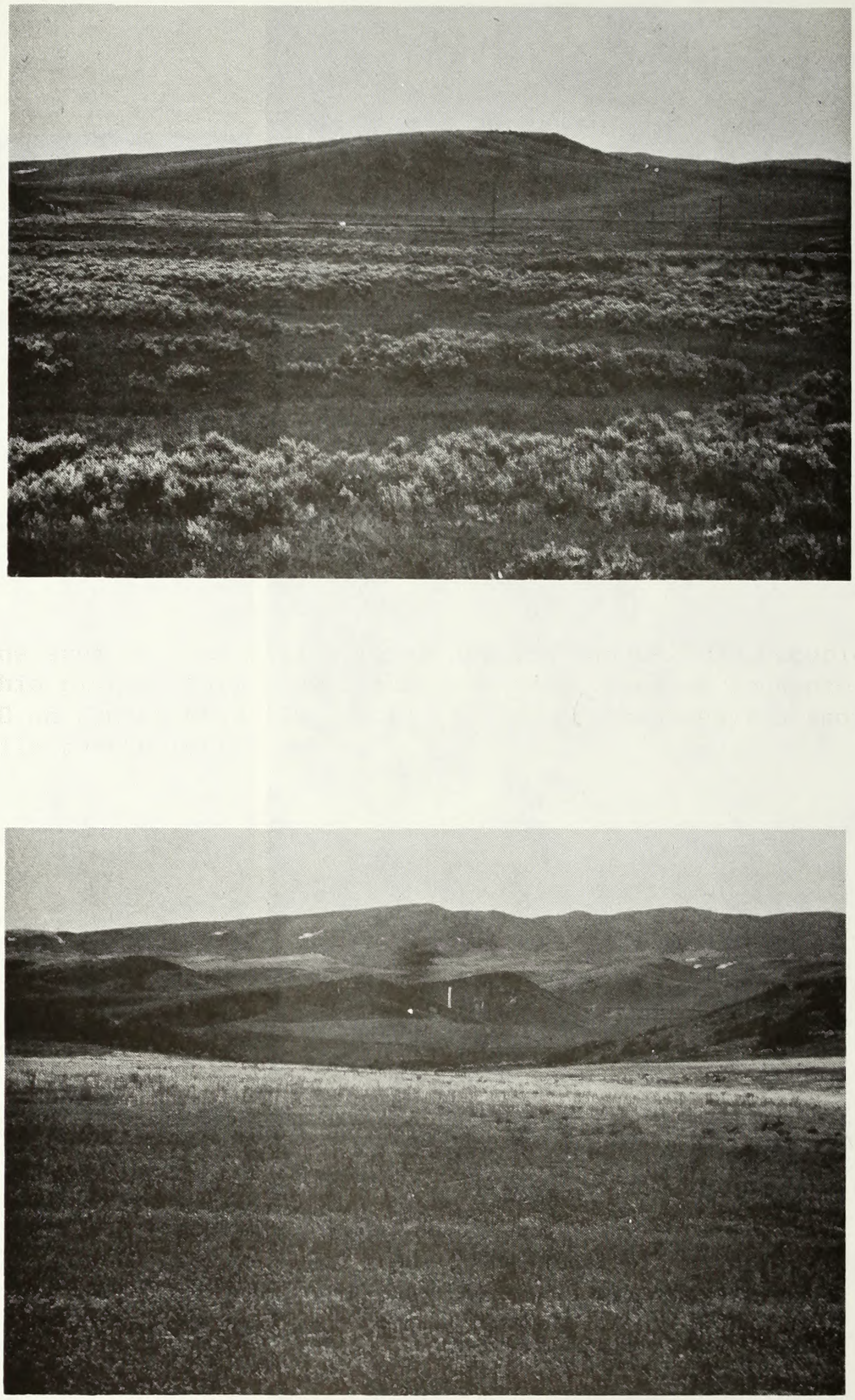

FIGURE EII-37

A more distant view in the same direction (west) also shows Competitive lease C-22676 plus the toe of the Energy 3 spoil pile (see upper right-hand corner). Viewshed sequence CD on County Road 33 provides this view.

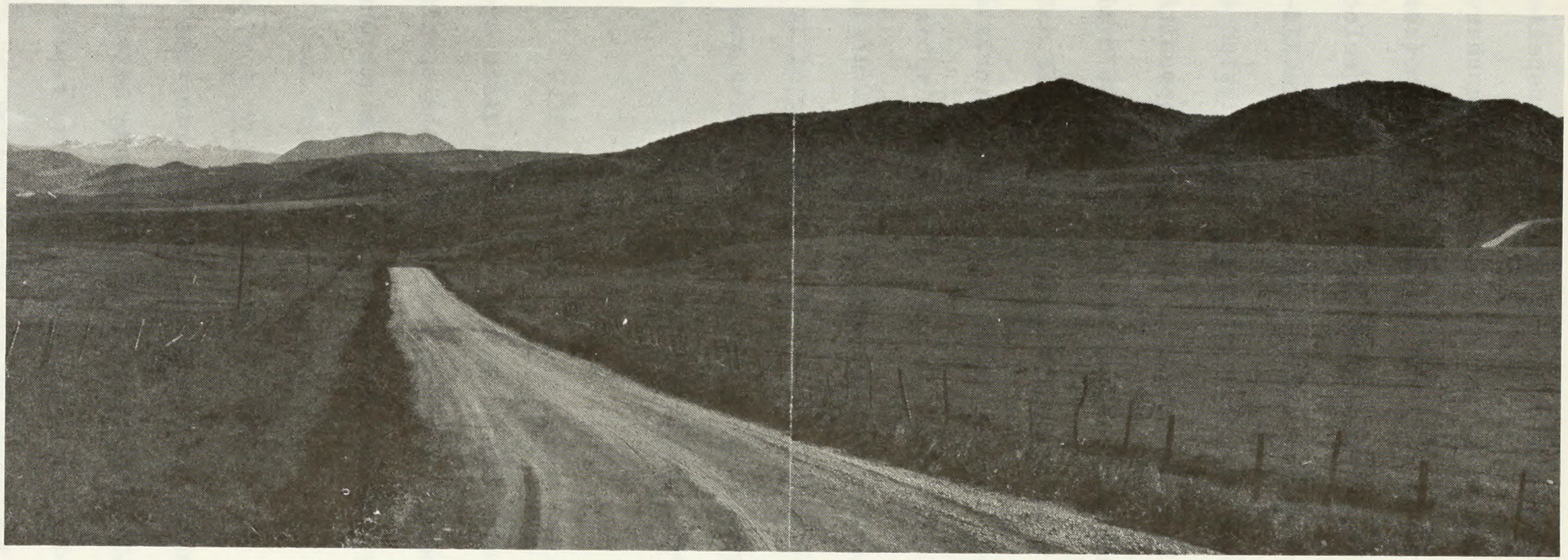

FIGURE EII-38

From the intersection of County Roads 29 and 33, this panorama shows the portion of competitive lease application C-22676 that is visible; it is almost completely visible as a mixed foreground and middleground landscape.

trails. An existing 230-kv transmission line with lattice steel structures crosses this foreground landscape; the pillar of overburden that supports one of the structures is surrounded by the exposed coal seam (see Figure EII-36). Viewshed sequence NO provides foreground views to relocated Fish Creek and an adjacent overburden deposition area (see Figure EII-37), at a low viewing angle. This visual unit also contains the railroad and several exploration trails and electric distribution lines lying opposite it.

The eastern unit of competitive lease application C-22676 also lies in a foreground visual unit visible from viewshed sequence EF. This area is also visible as background from two other viewshed sequences (see Figure EII-38).

The western unit of competitive lease application C-22676 is middleground when viewed from three viewshed sequences, but some of it cannot be viewed from any viewshed sequence. A small portion of this area also is visible as background (see Figure EII-30).

Recreation

Refer to Chapter IV of the Regional Analysis for a discussion of the existing recreation environment. The following paragraphs specifically outline recreation resources and current uses in the area surrounding Energy Mines.

Resources

Noteworthy wildlife viewing opportunities occur during the winter as several elk concentrate on old mine spoils, and southerly exposed hillsides, and rimrock ledges north of Energy 1 mine. Ranchers have reported elk in their fields about one mile northeast of the Foidel School.

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Seasonal concentrations of waterfowl offer viewing opportunities along all perennial streams in the area; beaver are reported in these same drainages (Croonquist, DOW 1975).

Seasonal upland game bird viewing occurs in a sage grouse strutting ground and a sharptail grouse dancing ground which lie adjacent to the Energy 2 mine (Williams Fork Unit Resource Analysis, BLM 1974). See Chapter II, Terrestrial Fauna, for a more complete description of wildlife resources.

One known raptor nesting area lies immediately north of and adjacent to Foidel school on the rimrock escarpment.

Good small stream fishing occurs on the following streams, listed in descending order of quality: Trout, Fish, Middle, and Foidel Creeks. Though they lie on privately-owned surface acreage, all are generally open to fishing with permission (Croonquist, DOW 1975). However, on a regional basis the latter three have only marginal capabilities to attract and sustain fishing use. See Chapter II Aquatic Biology for a more complete description of fisheries.

The BLM's Williams Fork land-use plan contains an analysis of the land's capability to attract and accommodate recreation use. Figure EII-39 displays relative inherent capabilities of various land units in the area; this rating does not imply management but merely looks at the resources in their present condition.

Existing recreation developments

One private recreation operation, Green Acres, lies adjacent to the Energy 2 mine area. Forty acres of this big game hunting area lies within existing Federal coal lease C-081330 (Soil Conservation Service, NACD Private Recreation Inventory 1975), (see Figure EII-40).

Recreation Capability Classification

Legend for Figure EII-39

I. Capability Classes:

(Capability to attract and to accommodate recreation)

Class 1 - Very high; intensive activities
2 - High; intensive activities
3 - Moderately high; intensive activities
4 - Moderate; dispersed activities
5 - Moderately low; dispersed activities
6 - Low; dispersed activities
7 - Very low; dispersed activities

II. Sub-Classes:

(Recreation resources)

A - angling
E - vegetation
M - small water bodies
O - viewing upland wildlife
P - agricultural interest
Q - topographic - landscape variety
R - rock formations
V - panoramic view
W - waterfowl viewing
XO - off-road vehicle use
XS - snowmobiling
ZC - coal mines

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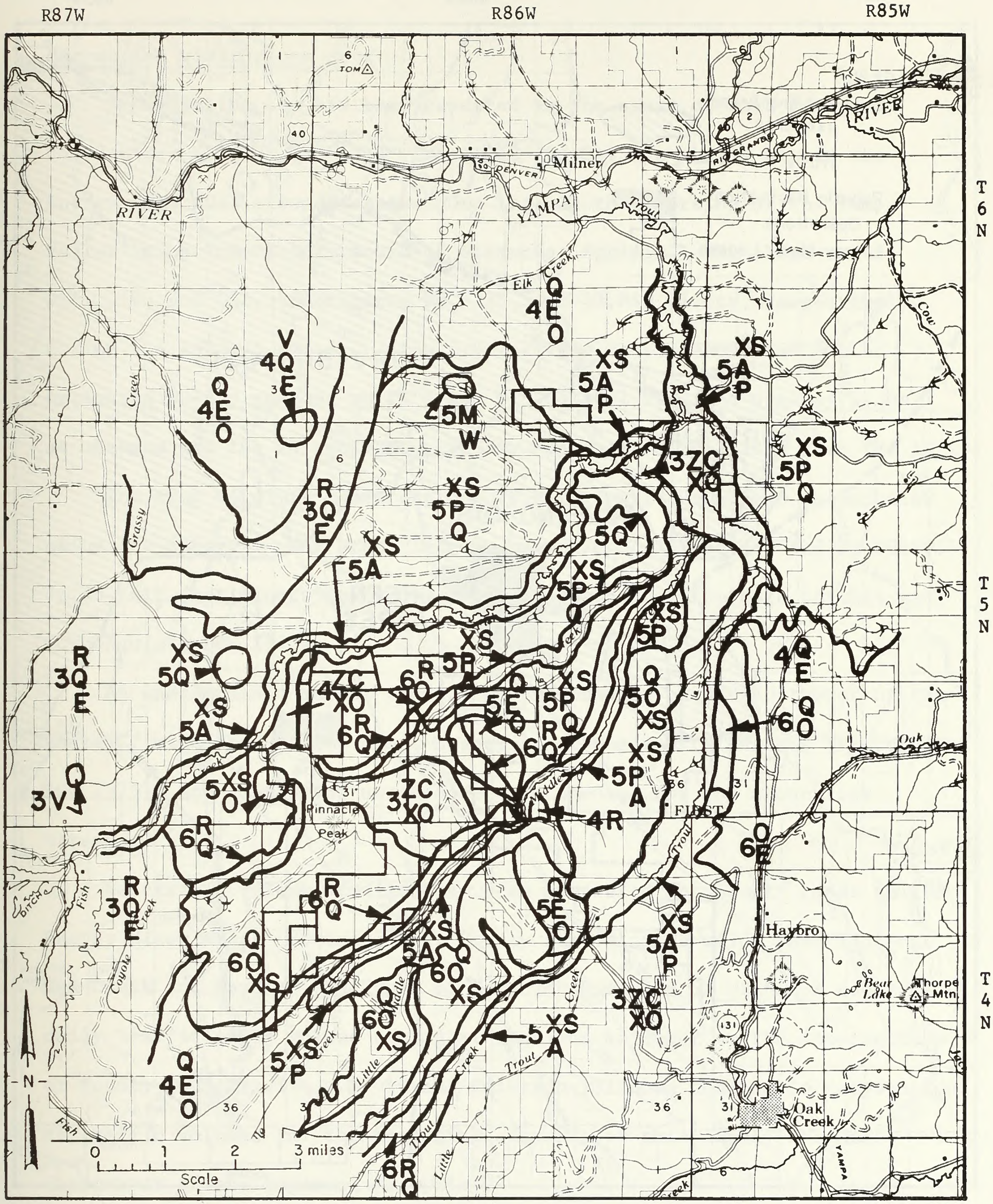

FIGURE EII-39

Recreation capability classification for the Energy mines area.

SOURCE: BLM, Williams Fork URA, 1974

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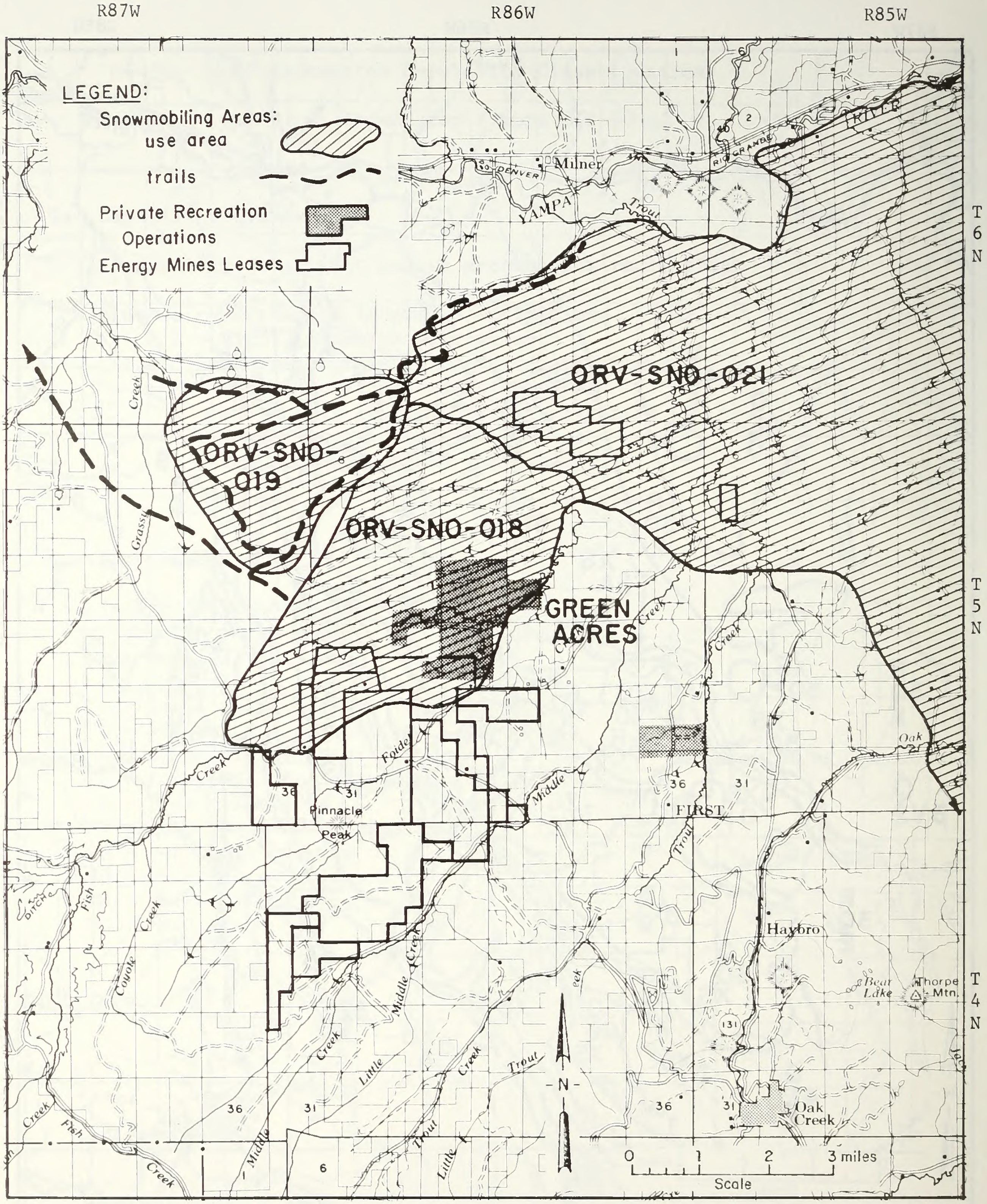

FIGURE EII-40

Visitor use and privately owned-and-operated recreational developments at the Energy mines area.

SOURCES: Bureau of Land Management, Williams Fork URA, 1974
Soil Conservation Service, NACD Private Recreation Inventory, 1975

Recreation visitor-use data

Snowmobiling use has been reported in the areas of both Energy 2 and 3 mines (Figure EII-40). Areas 018 and 019 lie wholly within the Energy area; 021 extends eastward to include that portion of the Yampa Valley lying immediately south of Steamboat Springs. The three areas, 018, 019, and 021, contributed 50, 120, and 42,840 visits, respectively, during the 1972-73 season. Area 018 received only weekend use for an estimated 90-day season, while areas 019 and 021 received weekday as well as weekend use for an estimated 120-day season (BLM, Williams Fork URA 1974).

The area Wildlife Conservation Officer reports from 5-10 snowmobiles using the Energy 1 mine area, largely on weekends in January and February. It is felt that miners and local ranchers constitute the bulk of this use (Croonquist, DOW 1975).

An undetermined amount of sage grouse hunting occurs northwest of the Energy 2 mine area on the Cross Mountain and Camilletti ranches (Croonquist, DOW 1975), and no fishing use has been documented for the above four streams.

No traffic volume studies have been completed for county roads in the Energy Mines area. However Routt County Road 27 is a major road linking Oak Creek and Hayden. Analysis of Colorado Division of Highways average daily traffic (ADT) volume counts at stations adjacent to the intersection of County Road 27 with U.S. 40 and Colorado 131 does not enable computation of traffic volumes for the beginning segments of this county road (see Chapter IV of the Regional Analysis).

Social Environment

The social environment that would be affected by Energy Fuels Corporation's proposed mine expansion extends from the immediate surrounding area of the mine site in Twentymile Park, west to Craig and Hayden and east to Steamboat Springs, Oak Creek, and Yampa. There are no housing subdivisions or other major developments in the immediate area. Only four residences are within a mile of any proposed area to be mined.

Of the five communities, Craig is the largest with a current population of about 6,000. Both Craig and Hayden (with Hayden's current population of about 1,700), are experiencing boomtown conditions now, due to the construction of Colorado-Ute Electric Association's power plant and Utah International's surface coal mine. The housing market is tight; the crime rate is increasing sharply; and new demands are being placed on already over-utilized social support facilities, (e.g., water and sewer treatment, schools, etc.). These conditions will probably continue over the next three years, until the power plant construction is complete.

Steamboat Springs, with a current population approaching 6,000, is known principally as a winter recreation resort. According to a preliminary Routt County master plan, Steamboat Springs can be expected to grow to a permanent population exceeding 10,000 by the mid-1980s as a result of additional winter recreation developments.

Oak Creek and Yampa, with populations of 1,200 and 350 respectively, are relatively small communities in the southern portion of Routt County. Both communities can expect some increase in population as a result of winter recreation developments in Routt County, although not as extensive as that expected near Steamboat Springs.

For a more extensive analysis of the social environment, refer to Chapter IV of the Regional Analysis.

Economic Conditions

In areas that would be affected by the expansion of the Energy mines, the industrial sectors employing the most people are agriculture, retail trade, and construction. In the future, it is expected that the mineral-extracting and recreation service sectors will gain in importance, as the development of non-coal related energy resources and of recreation facilities proceed.

Currently the agricultural sector generates the vast majority of earnings in the area, but in the future, earnings in the minerals extractive industries (other than coal) will expand rapidly.

The standard of living in the area, measured in terms of 1973 per capita personal income, is about $4,700, approximately six percent less than State and national averages. This difference from State and national levels is probably the result of the lack of a strong manufacturing sector, which traditionally is a high income industry.

For a more extensive analysis of the economic conditions, refer to Chapter IV of the Regional Analysis.

Transportation Networks

Highways

At the present time Colorado 131 passes about five miles to the east of Energy 1, and U.S. Highway 40 passes about the same distance north of

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Energy 3. These are the closest approaches of any major highways to the three Energy Fuels mining sites located southwest of Steamboat Springs, Colorado.

Highway 40 is a widened, two-lane, paved highway designed for somewhat heavier traffic than it is now sustaining, but not suitable for the heavy transport of coal using diesel trucks (Prosence 1975). Highway 131 is a relatively narrow, two-lane, paved highway basically designed for lightweight traffic.

Railroads

At the present time, the Energy Fuels mine sites southwest of Steamboat Springs are served by the Energy spur running northeast to the D&RGW Craig branch line out of Milner. This spur now serves the producing mines of Energy Fuels Corporation.

Tipples for loading coal produced by Energy Fuels mines already exist on this spur track. The exact location of these two active tipples are: (1) 14 miles southwest of Steamboat Springs, at Energy Fuels 3 site, on the Energy spur, in the south half of Section 1, T.5N., R.86W., Routt County, and (2) 22 miles southwest of Steamboat Springs, at Energy 1 site, the end of the Energy spur in Section 31, T.5N., R.86W., Routt County.

Airlines

The closest airport to Energy Fuels mine sites is the Steamboat Springs Airport which is served by Rocky Mountain Airways. Another close airport is the Yampa Valley Airport near Hayden, regularly served by Frontier Airlines, and now undergoing a ten million dollar improvement program.

Chapter III

Environmental Impacts of the Proposed Action

THIS CHAPTER ANALYZES IMPACTS OF ENERGY FUELS CORPORATION'S PROPOSED MINE AND RECLAMATION PLAN ON THOSE RESOURCE VALUES DESCRIBED IN THE PRECEDING CHAPTER. IT IS ASSUMED IN THIS CHAPTER THAT NO EFFORTS WILL BE MADE TO MITIGATE IMPACTS. IN THIS MANNER ALL PROBABLE IMPACTS CAN BE IDENTIFIED AS THE BASE FOR THE DETERMINATION OF MITIGATING MEASURES AND UNAVOIDABLE ADVERSE IMPACTS IN THE TWO SUCCEEDING CHAPTERS. WHERE DATA ARE AVAILABLE, IMPACTS ARE LINKED TO SPECIFIC ASPECTS OF THE PROPOSED ACTION AND ARE QUANTIFIED AS TO MAGNITUDE, INTENSITY, DURATION, AND INCIDENCE. ALTHOUGH THE PURPOSE OF ENERGY FUELS CORPORATION'S RECLAMATION PLAN IS TO LESSEN ADVERSE CONSEQUENCES OF SURFACE DISTURBANCE, THE IMPACTS RESULTING FROM IMPLEMENTATION OF THEIR PLAN ARE ADDRESSED IN THIS CHAPTER.

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CHAPTER III

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

Non-living Components

Geologic and Geographic Setting

Topography

Topography of the mined areas would be modified slightly due to removal of natural irregularities including small tributary stream valleys, and replacement with a man-made surface. The general surface at each mine is expected to stand slightly higher because of the increase in overburden bulk resulting from breaking up the original beds of rock, moving, and dumping them.

Stratigraphy

A small part of the stratigraphic section would be obliterated where mining takes place, as beds are stripped down to the mined coal bed and then replaced as mine spoil.

Structure

Structure in the strata would be obliterated down to the mined coal bed. The record of any small faults, joints, or folds that may be present would be removed in the mine area.

Geomorphology

Landforms would be modified by this mining, as natural surface features are replaced by manmade forms. Some modification has already taken place: replaced fill in some areas presents a locally bulging aspect above the surrounding smoother natural surfaces; this is likely to be the case especially in the Energy 2 mine area, because of the greater ratio of overburden to coal bed thickness.

Small intermittent streams draining the mining areas would be removed. Some alteration of the main streams may take place; this has already happened in the Energy 3 mine area (Figure EII-11) where Fish Creek has been rerouted around a large fill from mine spoils. Some of these streams, especially Fish Creek, are meandering streams. Man's alteration of such streams generally means straightening their courses; this shortens the course and consequently increases the velocity, raising the possibility of erosion and downstream deposition of sediments.

Spoils from the Energy 1 mine have been placed along the crest of the ridge as well as on the mined gentler ridge slope. Debris from these spoils has been washed and some has moved in small landslide, slump, or creep movements down the steep southeast slope of this ridge (Figure EIII-1). A small amount of this debris has reached the county road, and it is conceivable that larger masses of it could be carried over the road and into Middle Creek, creating problems of road maintenance and stream flow.

Following mining and reclamation in the Energy 1 area, ground water rising along known or unknown fractures into the base of the fill material could lead to slump and small mudflow actions along the toe of the fill.

Paleontology

Impacts to fossils would occur as they are removed in the coal mining operation. It is likely that at least some fossil destruction would occur.

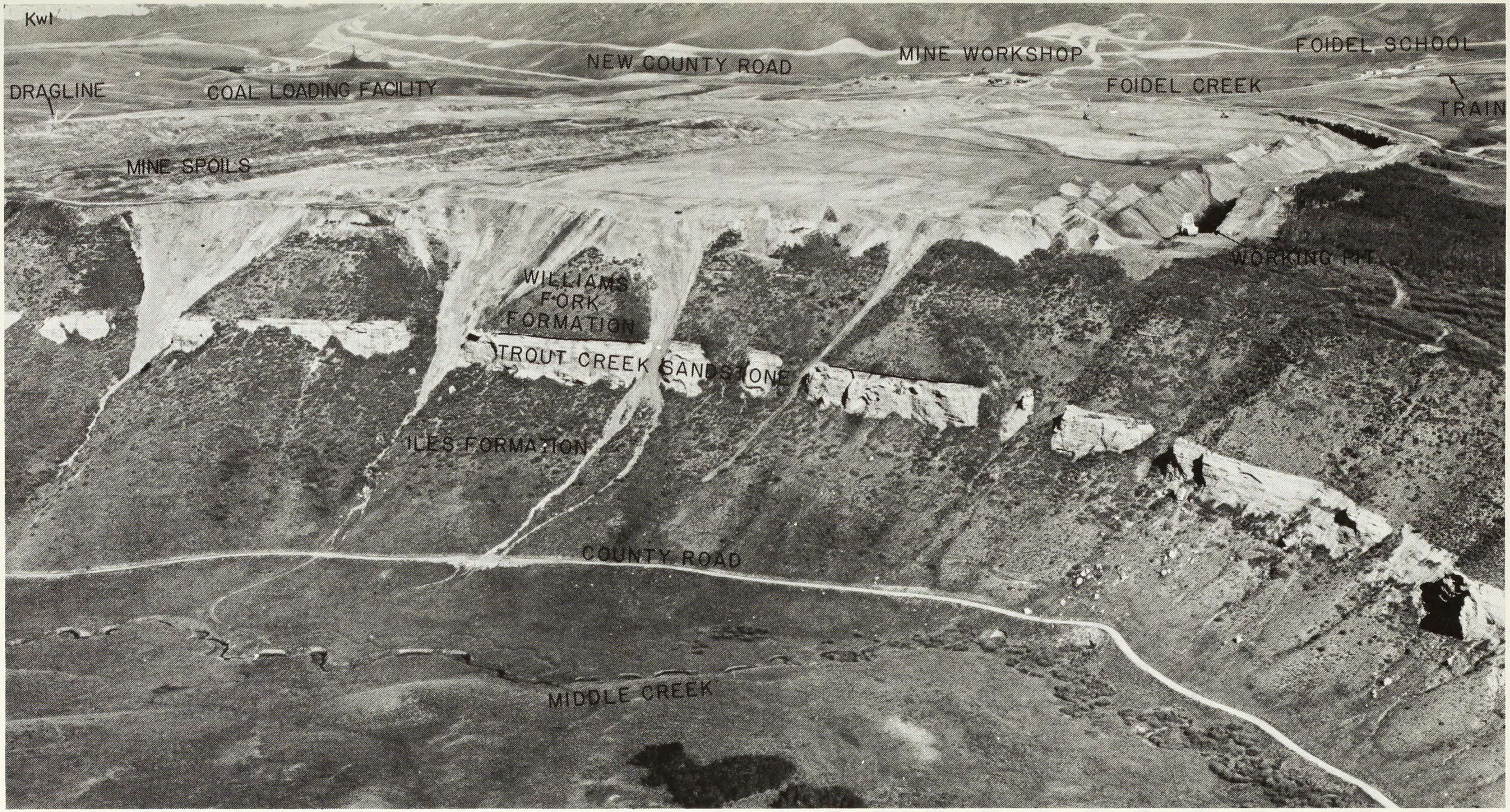

FIGURE EIII-1

Aerial oblique photograph, view north, of Energy 1 mine area. Debris slides, from mine spoils placed at crest of ridge, have formed on steep south face of ridge. (Kwt, Twentymile Sandstone Member).

Mineral Resources - Coal

No significant impact on mineral resources by this mining activity is expected with the exception of coal.

A beneficial effect of Energy Fuels Company's mining methods would be the recovery of more coal than would be possible by underground methods.

Coal resources of the region would be depleted by the sum of coal produced, plus coal lost in mining. A ten percent loss of the mined coal bed is the generally accepted figure with the mining methods used; about one foot of coal would be lost in Energy 1 mine, or about 1,800 tons/acre. In Energy 2 mine, ten percent would be 0.4 foot of coal lost in mining, or about 720 tons/acre. Energy 3 mine, working privately owned coal, has a coal bed with thickness comparable to Energy 1 mine; the loss there and on the requested competitive leases would be comparable to Energy 1 losses.

Coal resources in thin beds above the mined beds, if disposed of with other overburden rather than recovered during mining, would be an additional loss. The company describes the Lennox coal bed as being about 52 feet above the Wadge in Energy 1 mine and "usually only 2 1/2 to 3 feet thick" but ranging up to 4 feet; if not recovered, this bed's loss would mean a reduction of the coal resources by about 4,500-5,400 tons/acre.

Water Resources

Ground water

The extension of mining into areas adjacent to the present Energy 1 mine is not likely to cause any appreciable change in the present ground water flow regime to Foidel Creek. Most of the area proposed for mining is either drained by present mining activities or never contained any ground water due to its relatively high topographic position. The entire mining operation in a proposed new mine southwest of Energy 1 mine in Sections 17 and 18, T.4N., R.86W. (coal lease C-081330) is likely to be too high topographically to contain ground water.

Energy 2 mine would continue to produce ground water as the mining operation extends southeast into coal lease C-0128433 and competitive lease application C-20900; the amount and quality is not likely to change. Water discharged from this mine does not cause any problems, now nor is it likely to in the future. As the mining operation moves east along Fish Creek, coal that is to be mined is exposed along the side of the valley; since the coal slopes toward this exposure the material that is mined might be drained, and water yielding beds might not be encountered.

The principal long term impact on the area mined by Energy Fuels would be the destruction of the natural ground water flow systems. Water normally enters the soil and moves down through the rocks into the sandstones and coals, and thence into springs and streams; ground water flow helps sustain stream flow. In this formation the overall permeability of the spoils is apparently very much less than that of the undisturbed rock. Because of resultant spoils, the amount of water that enters the rocks and eventually reaches the streams as ground water may be greatly reduced; however, this reduction would be very small in terms of total stream flow. In the case of the Energy 1 and 2 mines the current ground water flow toward the streams reaches a maximum of only about 100 gpm, the loss of which would hardly be noticed in the stream flow. Even when all areas amenable to strip mining have been mined, the loss in ground water flow to streams is not likely to be great.

Mining is also taking place at Energy Fuels 3 mine in Section 1, T.5N., R.86W. Coal at this site is the Wadge bed, the same bed being mined at Energy Fuels 1 mine. This bed extends northwest-southeast, and Energy Fuels plans to mine it over distances two miles in either direction from the present mine. The mine will not be continuous however, due to the presence of the valleys of Fish and Trout Creeks and their tributaries that cross the outcrop of the coal.

Potential contributing areas for surface and subsurface runoff in the area to be mined at Energy 3 are small compared to either Energy 1 or 2. The amounts of water accumulating in pits is therefore expected to be smaller, and the average rate of pumping from pits during spring runoff should not exceed 50 gpm. The water quality is likely to be similar to that from Energy 1 mine (Table EII-3a). No adverse impacts are expected as a result of discharging this water into streams.

The mining proposed by Energy Fuels will result in the destruction of minor aquifers that supply few wells and springs. Energy 1 mine may destroy two springs and may cause a third spring to dry up; Energy 2 mine may destroy three wells and three springs, depending upon the extent of the mine pits in these areas, and if some of the coal in these areas is extracted by underground methods. There are no known wells or springs that will be affected by the Energy 3 mine.

Surface water

Mining activity proposed by Energy Fuels Corporation would result in 5,170 acres (8 square miles) of disturbed land in Trout Creek watershed during the next 15 years. This surface disruption would include direct impacts on Fish Creek, and Foidel Creek. In addition to these direct impacts there would be associated impacts on the receiving streams of Trout and Middle Creeks, respectively. Dissolved solids and sediment loads from the mine areas would eventually reach the lower streams as flow conditions occurred to permit transport of the loads.

Physical nature of streams

Strip mining operations could seriously alter natural drainage of the streams in Trout Creek watershed. Mining activity along Foidel and Fish Creeks could disrupt the natural channel of these two streams. Channelization (i.e., straightening) or diversion of these streams would result in the destruction of the physical characteristics at these locations and below. Alteration of the natural stream channels would change flow characteristics of these streams. Channelization from their existing meandering pattern would result in an increased stream gradient, and therefore an increase in velocity of stream flow. Increased stream flow velocity would result in alteration of stream channels in the watershed below the mining sites, because of increased undercutting of streambanks and increased transportation and deposition of sediment. An example of the potential deleterious effects of strip mining activities on streams may be seen at the existing Energy 3 mining operation. As shown in Figure EII-11, overburden which was removed prior to mining was dumped across the natural channel of Fish Creek. Fish Creek was channelized around the mountain of overburden with little regard for maintenance of flow characteristics or water quality.

Channels of any intermittent tributary streams in the proposed strip mining areas would also be destroyed; this would require establishment of new drainage patterns following mining operations and reclamation procedures at these sites.

Quality of streams

Strip mining activities across streams or in their vicinity would increase the sediment load of these waters. The existing Energy 3 (Figure EII-11) mining operation may again be used as an example. Here Fish Creek has been channelized so that it flows directly along the base of the spoil pile, allowing runoff water from the overburden to directly enter the stream; no effort has been made to stabilize or reclaim the overburden, resulting in a highly erodible landscape. Consequently sediment load in Fish Creek increases significantly as it flows beside the overburden pile. Other sources of increased stream sedimentation at the proposed mining locations include: (1) erosion of spoil piles placed adjacent to streams, (2) random pumping of groundwater from mine pits into local streams, (3) erosion of road cuts and adjacent land[1], (4) placement of topsoil stockpiles in locations where they will be highly susceptible to erosion and (5) sloughing of spoils over cliffs in a manner that will increase erosion into the stream valleys below (Figure EIII-1).

Due to the nature of the mine plans at Energy 1 and 2 any sediment that would be generated from the unshaped mine spoils would be deposited in the mine pits. Rehabilitated areas would, however, yield about 1,110 tons of sediment/year from the average 343 acres/year of disturbed land, and from land that has been revegetated but is still subject to accelerated erosion. No new haul roads are planned, but there will be some sediment produced from existing haul roads.

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[1] This is currently a major erosion problem at many locations in the existing Energy Fuels mining area.

An increase in sedimentation will also affect other water quality parameters. An increase in the turbidity (i.e., a measure of the transported sediment load of the stream) would produce a proportionate increase in water temperature due to the propensity of suspended sediment to absorb heat, and concurrently lower the dissolved oxygen (DO) content of the stream.

An increase in TDS would also occur in the streams that would be impacted by the proposed mining activities. This would result from pumping ground water encountered in the mining process into local streams, and from leaching spoil piles during mining activities and reclamation procedures. On-site investigations by EIS team personnel showed that ground water which had accumulated in existing pits at Energy 1 and 2 mining areas was higher in TDS than local stream surface water (Table EII-3a). The pit water is being deposited by pumping or natural underground flow into local streams resulting in a measurable increase in TDS below the influent. An increase in TDS could deteriorate the chemical quality of the watershed to the detriment of downstream uses. For instance, a significant increase in TDS would render water in Trout Creek drainage undesirable for irrigation purposes.

Field investigations by EIS team personnel reveal possible contamination of Foidel Creek resulting from coal dust blowing into the stream from the tipple and from passing railroad cars. Bottom material in Foidel

Creek downstream of the tipple consists primarily of fine, black, organic material, which could be the product of accumulated coal dust. Continuous accumulation of coal dust in streams would increase the BOD, and reduce the DO content of the water due to oxidation of organic material contained in coal dust; it would also eliminate many critical riffle areas.

Air Quality

Emission sources

To determine potential changes in air quality due to operation of the proposed Energy Fuels Mines, emissions from all facets of the mining operation must be determined. These emissions must then be interpreted in terms of the ambient pollutant concentrations they produce in the air. Since there are three distinct mines, Energy 1, 2, and 3, data and analysis will be given separately for each.

Five general sources of atmospheric emissions would be created by the proposed development at each mine. These sources might emit both fugitive dust and suspended particulates in the air, so a clear distinction should be made here. Suspended particulates are all kinds of particles, liquid or solids, that are small enough to act in the atmosphere in a manner analogous to a gas and not settle out rapidly due to gravity. Any disturbance of the earth's surface or the movement of material generates dust. If the dust is not prevented from becoming airborne at the source, it is called fugitive dust. Once in the air, not all fugitive dust will be classed as suspended particulates. Some will be large enough to fall out rapidly near the source. These particles generally are not included in the suspended particle category.

The five sources of air pollutants at the mine are:

1. Mining. Three distinct phases of material handling during coal mining can be identified as major sources of fugitive dust: topsoil removal, storage, and replacement; overburden removal, storage, and redistribution; and coal removal and transport. Each produces a different degree and character of fugitive dust. Minor sources of fugitive dust are generated by blasting, scraping, loading, and dumping of materials.
2. Process. Mined coal must be processed to produce a product suitable for marketing. Coal conveying, sorting, crushing, and storage are processes that produce fugitive dust. Control devices that collect and retain generated dust emit some particulate matter.
3. Roads. Unpaved roads are a source of fugitive dust from all traffic and from wind erosion. New emissions will result from increased traffic on mine access roads and roads within the mine boundaries.
4. Coal Fires. Coal fires in overburden piles and in exposed seams are a source of sulfur oxides, carbon monoxides, nitrogen oxides, and particulates.
5. Vehicle Emissions. Particulates, hydrocarbons, carbon monoxide, nitrogen oxides, and sulfur oxides are emitted by mine vehicles, including scrapers, bulldozers, haulage trucks, light-duty trucks, and employee and service vehicles. (See Gaseous Pollutants section following).

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Based on current regulations, the only significant pollutant generated by the first source, mining, will be suspended particulates which result from fugitive dust. Emissions estimates from materials handling in mining have been developed for topsoil, overburden, and coal separately, but with the same methodology. All the operations of removing the material from the ground, transport, piling, and redistribution have been combined into a single emission calculation using estimates developed from other studies of fugitive dust. Detailed calculations and references are given in Appendix D.

For mining, a fugitive dust emission rate of 0.0055 percent of the material handled has been calculated. This rate must be corrected for climate and control measures at the mine. Wet, snow-covered, and frozen ground limits dust generation. About 65 percent of the days in a year are expected to be so classified at the Energy Fuels mine sites. Using a calculational scheme described in Appendix D that takes into account the differing response of individual mining activities to climate, the corrected emission rate of fugitive dust is 0.0024 percent of material moved.

It is expected that during dry periods water will be applied to surfaces to inhibit the formation of fugitive dust by vehicles. Efficiencies will be poor, about 30 percent (Appendix D). The net effect will be to reduce emissions to a controlled rate of about ten percent less than the uncontrolled rate given above.

Estimates of the quantities of material to be moved (Appendix D) were taken from the Description of the Applicant's Proposal submitted to the

BLM. In the years 1980 through 1990, an estimated 2,400,000, 1,200,000, and 1,300,000 tons of coal will be mined/year, necessitating removal of 39,600,000, 10,700,000, and 17,600,000 metric tons of overburden, and 474,000, 451,000, and 386,000 metric tons of topsoil each year for Energy 1, 2, and 3, respectively. Emissions estimates for this quantity of materials handling are shown in Table EIII-1 as controlled and uncontrolled emissions.

These calculated estimates of emission rates are realistic approximations of the complex interaction of variables that affect dispersal of particulate material. Uncertainties (two standard deviations) are estimated to be on the order of a factor of two. All of the rates are given as yearly averages, even though it is recognized that all the activities are not continuous.

As an operation of mining, blasting has not been included in the previously described emission calculations. Overburden and coal are loosened for removal by blasting on a regularly scheduled daily basis. At a blast frequency of twice a day, weekdays only, each blast would involve half of the day's production, or about 4,600, 2,300, and 2,500 metric tons of coal and 79,000, 22,000, and 35,000 tons of overburden, respectively for Energy 1, 2, 3 over a combined area of about an acre at each mine. Each blast normally takes place in a fraction of a minute. Unfortunately no emissions factors are available for blasting, but the quantities of fugitive dust produced would be small compared to other mining activities, simply because the blasting is so intermittent. Blasting has therefore not been added as a source in estimating fugitive dust emissions.

Process emissions of suspended particulates involve fugitive dust emitted from coal preparation for delivery, and fine particulate matter emitted directly to the atmosphere from control device exhausts. Control devices are routinely used to collect and retain coal dust with a 99 percent efficiency possible. Only one-half the dust, generated is collected and passed to control devices, so the controlled emission rate is one percent of one-half the uncontrolled rate, calculated in Appendix D to be .025 kilograms of fugitive dust/metric ton of coal, or a loss of .0025 percent of the coal. Emission totals are given in Table EIII-1 with the assumption that each mine has separate process facilities.

At the mine, there will be vehicle exhaust emissions from heavy diesel mine equipment and haulage trucks, and gasoline powered cars and trucks. Emissions from haulage trucks are calculated in Appendix D by considering the total yearly truck miles required to move coal to the processing facilities at the mine. Other mine diesel vehicles are considered to be a much smaller source than haulage trucks and have not been included.

Since emission factors for gasoline engines differ in distribution between pollutant but are of the same general magnitude per kilometer as those for diesel trucks, trucks cannot be considered alone. Emissions factors (Appendix D) show that cars emit about 80 percent more carbon monoxide than trucks, but almost six times less nitrogen oxides. Car traffic is expected to be significant at the mine, it will include general employee traffic and supervisor and service vehicles. Total kilometers have been estimated by assuming each employee travels a common distance within the mine site, approximately 6, 4, and 2 kilometers for Energy 1, 2, and 3, respectively.

Table EIII-1 lists within-mine and off-mine emissions from vehicles separately. No haulage distance to the railhead has been assumed. The off-mine emissions dominate the totals because automobile emissions were calculated by considering one round trip from Hayden per employee. The same car travel has been used to calculate fugitive dust from the off-mine roads, except that only one-third of the road is expected to be unpaved in each case. The road fugitive dust emission factor used was one kilogram per vehicle kilometer, as discussed in Appendix D.

Another possible source of emissions related to mining is the spontaneous or accidental ignition of coal fires in overburden piles and exposed coal seams. If a fire occurs, clouds of smoke containing suspended particulates, carbon monoxide, nitrogen oxides, sulfur oxides, hydrogen sulfide, and hydrocarbons can result. Estimates of frequency or quantity of emissions at any one mine cannot be made. However, if a fire occurs, the emissions may be substantial. McNay (1971) indicates that in the United States there were 270 burning coal refuse piles in 1968, 15 of which were in Colorado, over an area of about 130 acres; all were in older mined areas.

Resultant air quality

Particulates

Table EIII-1 lists five sources of suspended particulate from the mine. Vehicle emissions of particulate are usually not an air pollution problem, and are obviously insignificant in comparison to mining operations.

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TABLE EIII-1

Energy Fuels 1, 2 and 3 Mines Air Pollutant Emissions

(Metric Tons per Year)*

Source	Air Pollutant	Uncontrolled			Controlled		
Mining Materials		1	2	3	1	2	3
Handling: Topsoil	Suspended Particulates	6.4	7.0	6.0	5.8	6.3	5.4
Overburden	Suspended Particulates	800	220	370	720	200	330
Coal	Suspended Particulates	51	26	28	46	23	25
Process	Suspended Particulates	130	56	60	55	28	30
Fugitive Dust from Off Mine Roads	Suspended Particulates	260	130	140	180	91	98

Source	Air Pollutant	Within Mine						Off Mine		
		Cars			Trucks			Cars		
		1	2	3	1	2	3	1	2	3
Vehicle Exhaust	Suspended Particulates	0.15	0.049	0.026	0.42	0.14	0.077	1.2	0.62	0.65
	Hydrocarbons	1.18	0.58	0.32	1.2	0.40	0.22	15	7.4	7.9
	Carbon Monoxide	9.8	3.2	1.7	7.2	2.4	1.3	80	40	42
	Nitrogen Oxides	1.4	0.45	0.24	12	4.0	2.2	12	5.8	6.2
	Sulfur Oxides	0.027	0.012	0.0062	0.85	0.28	0.16	0.30	0.15	0.16

* 1 metric ton - 1.1016 short tons

Overburden removal, because of the large tonnages involved, would be the dominant mining source. It is assumed that the stripping would be continuous during active mining. The variations in emission rate have been averaged in the estimation of yearly emission rates, and in fact are the reason for not using shorter averaging times to specify emissions.

To assess the impact the mine would have on the atmospheric environment, estimates must be made of the ambient total suspended particulate concentrations resulting from the emissions specified in Table EIII-1. To do this, an atmospheric diffusion model has been applied to each mine site. The effect of local emissions are considered over long periods (annual averages) and in terms of short duration exposures (daily concentrations) in the model used here. All of the emissions shown in Table EIII-1, except fugitive dust from off-mine roads, have been added to represent a single source originating across each entire active mine site. These "area" sources spread over an assumed disturbed area of 180 acres for Energy 1 mine, 173 for Energy 2, and 148 acres for Energy 3, appear suitable considering the methods of calculating emissions and the wide variations in individual emission point characteristics during mining operations.

The model is described in detail in Appendix D. It is a Gaussian plume model that integrates contributions from across the area for specified meteorological conditions. It is adapted to a specific site by adjusting the dispersion parameters and the meteorological input. All Energy Fuel mines would be in a valley flow system where winds are often generated

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thermally to produce flow up the valley during the day and drainage down the valley at night. The topography of the mine sites and the associated mine operations provide source variations for enhanced vertical mixing due to mechanical turbulence. To account for this, an initial mixing height of ten meters (33 feet) has been assumed. This allows the pollutant to form a "puff" ten meters (33 feet) deep before dispersing downwind.

To model worst case 24-hour concentrations, it was assumed that a wind speed of .77 mps (2 mph) persisted in one direction for eight hours during limited mixing conditions (thermally stable atmosphere). The remaining 16 hours of the day were assumed to contribute nothing to the 24-hour concentration. To account for slight variability in the wind direction over the eight-hour period, concentrations were smoothed over a 22.5° sector. A complete description of this process is provided in Appendix D.

Meteorological input into the annual average computations is somewhat more qualitative. Here again only one direction was considered. It was assumed that down-valley flow occurred most frequently, about 20 percent of the time. This corresponds to the frequency of down-valley flow observed at Hayden and Craig weather stations. In addition it was determined from meteorological studies done near Craig and Hayden for the Yampa project, that of this 20 percent, 5 percent is likely to occur during atmospheric conditions which allow substantial vertical mixing (thermally unstable atmosphere); 11 percent is likely to occur when vertical mixing is inhibited (thermally stable atmosphere), and the remaining 4 percent when mixing is neither forced or repressed (thermally neutral atmosphere). A combination of these conditions weighted by their frequency of occurrence was used to provide annual average concentrations in the most probable wind direction. (A more comprehensive description of this modeling scheme is provided in Appendix D.)

The uncertainty in the calculated total suspended particulate concentrations can be approximated; it is estimated that the modeled concentrations are correct within a factor of three. This uncertainty could be reduced only by much more detailed and preferably measured emissions and meteorological data.

Table EIII-2 is a compilation of Federal and State ambient air quality standards, existing background concentrations, and diffusion model predictions. For an annual average, the highest concentrations expected are those in the prevailing downwind direction during stable conditions. The model sums contributions during all existing meteorological situations, but for a source close to the ground, the suppressed vertical mixing and low wind speeds during an inversion are expected to dominate. Air flow during these times will often be downslope. The largest predicted annual concentration is thus at the lowest edge of the mine site.

As shown in Table EIII-2 and Figure EIII-2, the decrease in concentration with distance will be rapid. Concentrations at Energy Fuels 1 (including the background of 20 $\mu g/m^3$) will exceed the Annual Federal Secondary Standard (60) out to 2 kilometers (1.2 miles) from the center of the disturbed area and Colorado Standard (45) for a distance of 3 kilometers (1.9 miles). Concentrations in other than the down-valley direction will be lower by at least 50 percent. Concentrations due to emissions from Energy 2 and 3 will be lower even in the down-valley direction by at least 50 percent, as shown in Figures EIII-3 and EIII-4.

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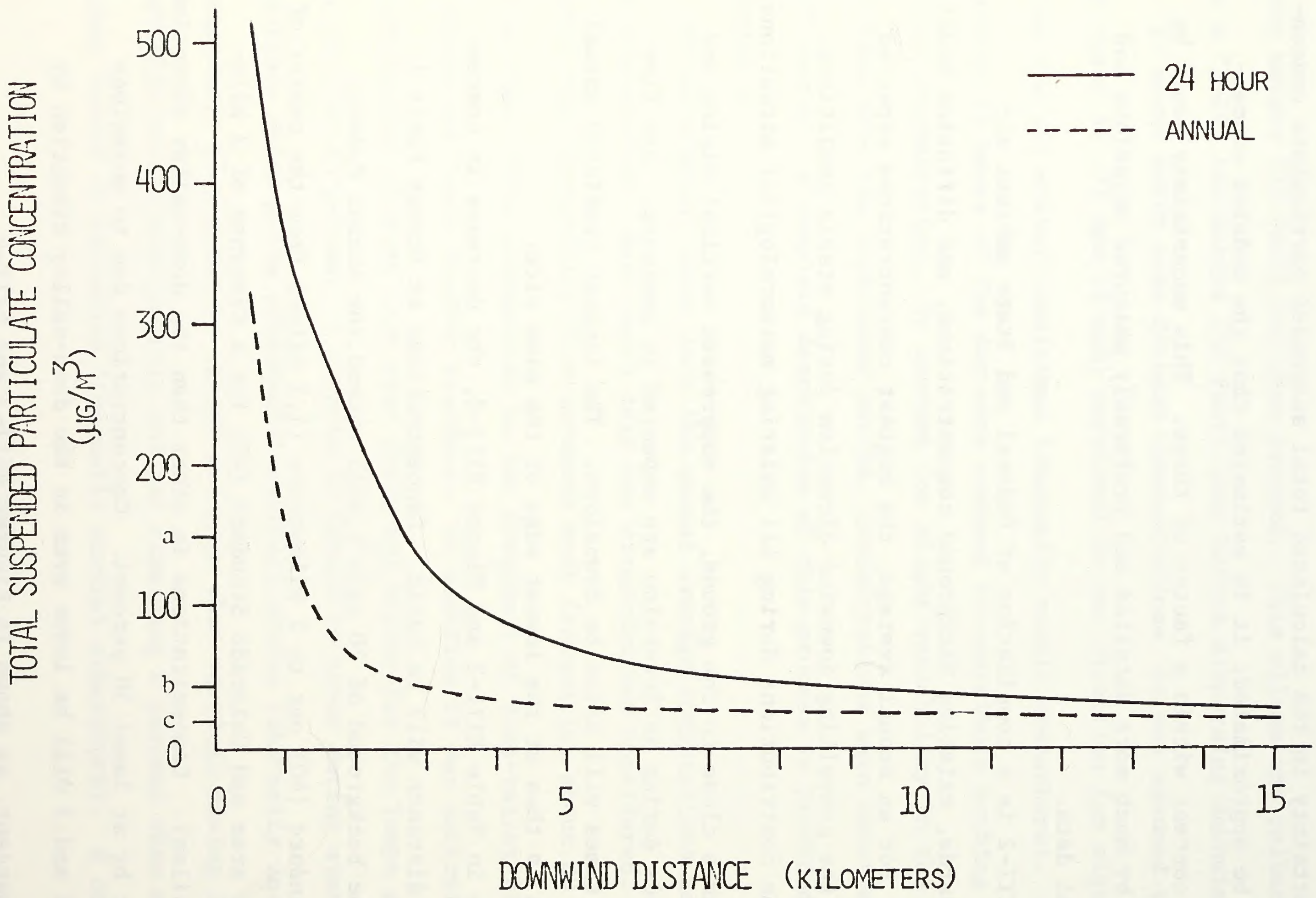

FIGURE EIII-2

Maximum down valley suspended particulate concentrations as a function of downwind distance from the Energy Fuels 1 center. (a, 24 hour State standard; b, annual State standard; c, baseline concentration).

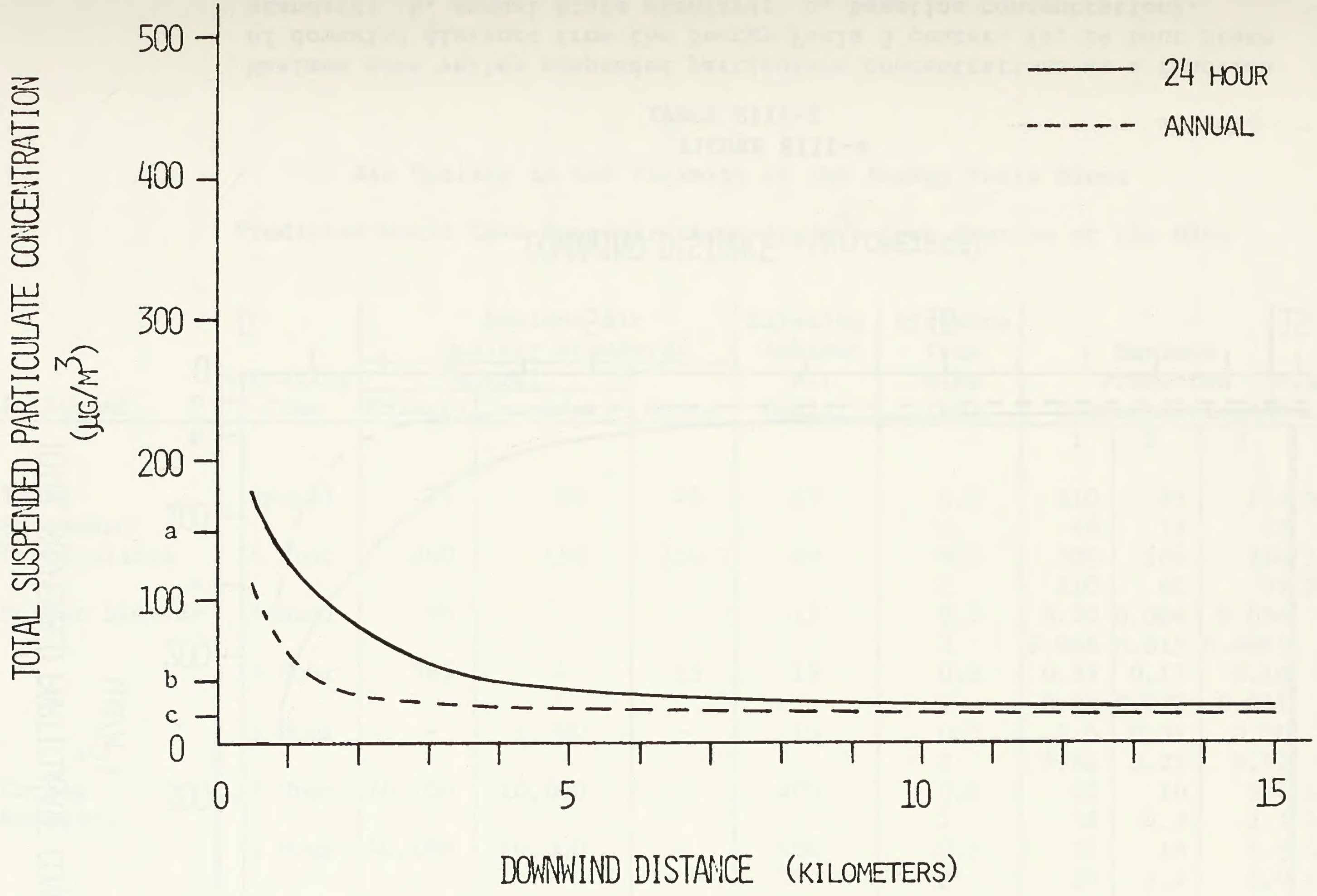

FIGURE EIII-3

Maximum down valley suspended particulate concentrations as a function of downwind distance from the Energy Fuels 2 center. (a, 24 hour State standard; b, annual State standard; c, baseline concentration).

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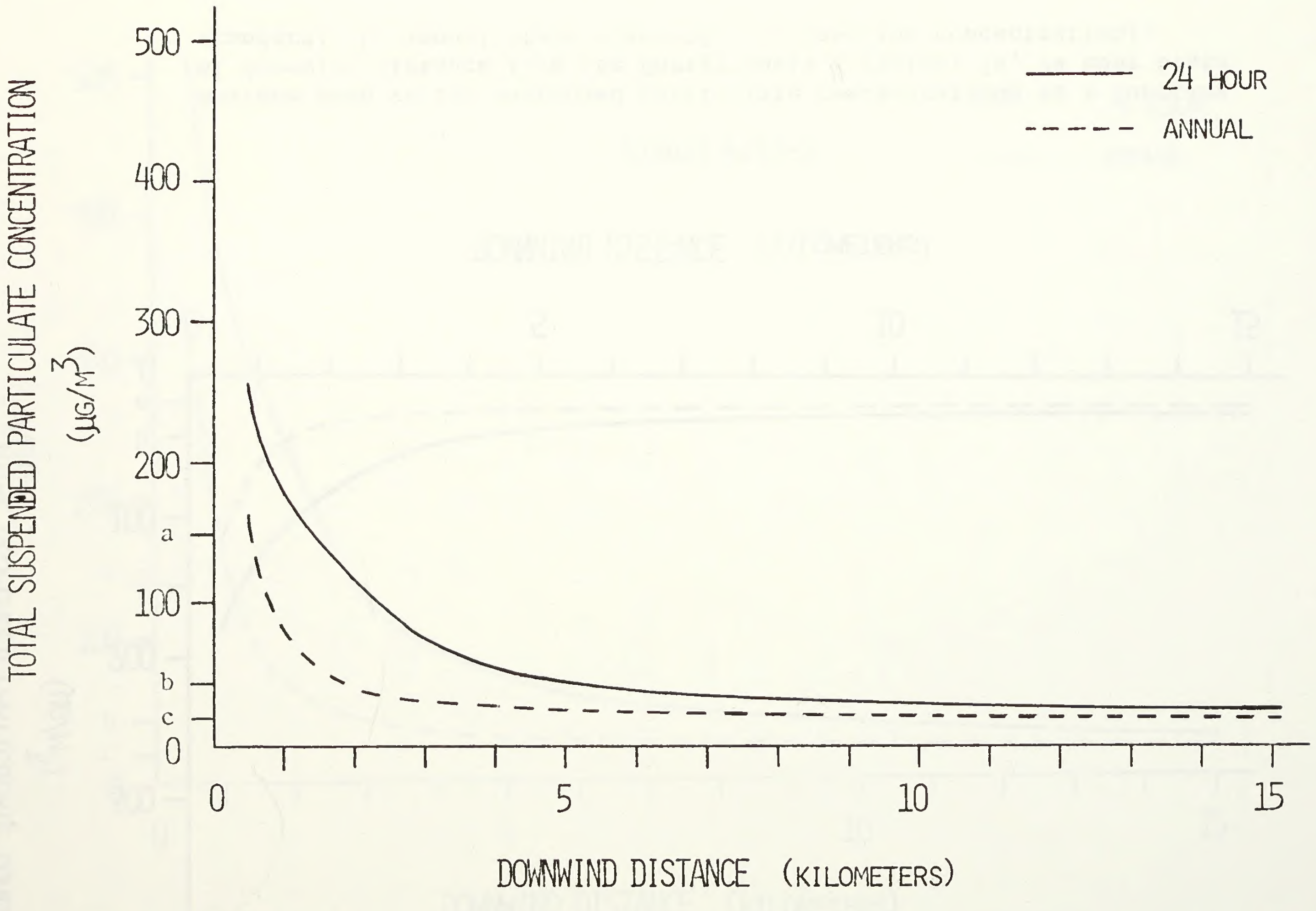

FIGURE EIII-4

Maximum down valley suspended particulate concentrations as a function of downwind distance from the Energy Fuels 3 center. (a, 24 hour State standard; b, annual State standard; c, baseline concentration).

TABLE EIII-2

Air Quality in the Vicinity of the Energy Fuels Mines

Predicted Worst Case Concentrations (μg/m^3) from Sources at the Mine

Pollutant	Averaging Time	Ambient Air Quality Standards			Existing Ambient Air Quality	Distance from Mine (km)	Maximum Predicted Concentrations			Predicted Plus Background Concentrations		
		Federal		State								
		Primary	Secondary									
							1	2	3	1	2	3
Total Suspended Particulates	Annual	75	60	45	20	0.5	310	95	145	330	120	160
						2	46	14	22	66	34	42
	24 Hour	260	150	150	20	0.5	500	160	240	520	180	260
						2	210	65	99	230	85	120
Sulfur Dioxide	Annual	80	-	-	15	0.5	0.20	0.064	0.036	15	15	15
						2	0.046	0.015	0.0085	15	15	15
	24 Hour	365	-	15	15	0.5	0.53	0.17	0.10	16	15	15
						2	0.22	0.072	0.041	15	15	15
	3 Hour	-	1,300	-	15	0.5	1.6	0.51	0.30	17	16	15
						2	0.66	0.22	0.12	16	15	15
Carbon Monoxide	8 Hour	10,000	10,000	-	400	0.5	44	10	5.4	440	410	410
						2	18	4.2	2.3	420	400	400
	1 Hour	40,000	40,000	-	400	0.5	74	18	9.5	470	420	410
						2	30	7.4	3.9	430	410	400
Non Methane Hydrocarbons	3 Hour	160	160	-	50	0.5	5.5	1.8	0.98	56	52	51
						2	2.2	0.74	0.42	52	51	50
Nitrogen Oxides	Annual	100	100	-	15	0.5	3.0	1.0	0.54	18	16	16
						2	0.70	0.23	0.13	16	15	15

Meteorological circumstances resulting in the largest predicted 24-hour total suspended particulates concentrations are those which contributed most to the annual average, the existence of stable conditions. It has been assumed that stable conditions with a wind speed of one meter/second (2 mph) persist for at least eight hours. This could occur in any direction, but is most likely in the down-valley direction. The meteorological information available indicates that concentrations on the order of those in Table EIII-1 will occur between 10-30 days/year. Because the emissions are concentrated, the predicted concentrations shown in Table EIII-2 are relatively large. At 500 meters (0.3 miles), the highest concentration will exceed the Federal Secondary and State Standards by a factor of three.

EPA non-degradation guidelines for Class II areas specify an allowable increase of 10 $\mu g/m^3$, annual average, and 30 $\mu g/m^3$, 24-hour average, for total suspended particulate ambient concentrations. These values will be exceeded in the prevailing downwind direction for distances of 6 km (3.7 miles), annual average, and 8 km (4.9 miles), 24-hour average.

On a short-term basis, stability and low wind speeds characterize high concentration periods as predicted by the model using constant emission rates. However on the opposite end of the wind speed distribution, since a good portion of the particulate emitted is from newly exposed surfaces, high velocity winds can greatly increase the generation of dust. The large disturbed area of the mine would be a source of blowing dust during gusty conditions, and some instances of very high ambient suspended particulate concentrations are inevitable. Wind conditions at the site are normally moderate. The velocity exceeds 10 meters/second (22 mph) about 3 percent of the time, part of which is associated with precipitation which inhibits dust generation.

The impacts of the two other potential sources of suspended particulates previously mentioned, blasting and fires, are difficult to assess. The cloud of dust produced by blasting is expected to be short-lived, at least compared to the averaging times of the standards (24 hours or greater) so that little contribution would be measured off the mine site. The dust produced will be created but also initially dispersed by the force of the blast. Blasting will generally take place during the day when meteorology characteristics are most favorable for dispersing pollutants.

Coal fires in spoil piles or other waste areas at the mine would be a major source of pollutants if allowed to spread to any large areas. Generally, available coal mixed in the overburden will be small and fires can be contained; however if a low-grade seam or small pocket of coal is mixed in the overburden, a fire could ignite spontaneously.

McNay (1971) reports suspended particulates, sulfur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons, (or all the regulated pollutants) can be emitted by a fire in sufficient concentrations to create a health hazard and aesthetic nuisance.

Gaseous pollutants

Vehicle emissions are the only source of gaseous air pollutants at the mine. Federal and State regulations limit ambient air concentrations of the pollutants carbon monoxide, hydrocarbons, nitrogen oxides, oxidants, and sulfur oxides. Of these, all but oxidants are emitted from vehicles.

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Oxidants, principally ozone, result from atmospheric chemical reactions involving other pollutants and sunlight. Based on projected vehicle emissions, it is highly unlikely that sufficient concentrations of other gases, specifically nitrogen oxides and hydrocarbons, will ever be present in the vicinity of the mine to result in a generation of significant above-background oxidant concentrations.

Emission estimates were made separately for off-mine and within-mine vehicles to facilitate impact assessment. The diffusion model used to calculate ambient particulate concentrations from each mine as an area source was applied to vehicle emissions. The off-mine vehicle exhausts could be modeled with a line source model, but complications result in many additional assumptions. Estimates would have to be made of non-constant variables such as vehicle frequency and regularity, meteorological conditions over a large area, highway terrain effects, and contributions of other sources.

Results of modeling with mine vehicle exhausts are given in Table EIII-2. As in the particulate case, the predicted concentrations decrease rapidly with distance from the mine. Emissions from diesel and gasoline vehicles have been added together in the consideration of the mine as an area source. Applicable air quality standards and existing background concentrations are also listed in Table EIII-2.

The sulfur content in fuels is such that the impact of sulfur dioxide emissions is negligible for all averaging periods. There is essentially no deterioration of air quality from this pollutant. The other pollutants in the exhausts will add measurable concentrations to the background, within 2 kilometers (1.2 miles) of the mine, but only to a maximum of an 8 percent increase. No ambient air quality standard will be threatened.

The within-mine vehicles are assumed in the model to be spread out over the entire disturbed area. In comparison, the off-mine automotive emissions will occur along the road system. The off-mine automotive emissions constitute a source ten times larger, as indicated in Table EIII-1. Ambient concentrations have not been modeled because of the lack of detailed input, but general estimates can be made by using approximation techniques from EPA, 1974. For carbon monoxide, at a distance of 100 meters (328 feet) from the road with a wind blowing along and slightly across the road, the maximum one-hour concentrations would be about 80 $\mu g/m^3$. This is a rough approximation, but it allows a comparison to Table EIII-2 where carbon monoxide concentrations of 74 $\mu g/m^3$ are predicted as resulting from within-mine vehicles. Compared to the standards, these levels are insignificant.

Visibility

The addition of particulates into the atmosphere around the mine, either directly as suspended particulate emissions or indirectly as a result of chemical reactions of gaseous pollutants, would reduce the visibility in the area. It was shown in the previous section that the gaseous contribution is expected to be minimal. A calculation of the degree of degradation from suspended particulates depends on several parameters for which data are not available, the most important being size distribution of the particulates. Total suspended particulate concentrations, however, can be used to estimate visibility with the understanding that the relationship is not well defined, especially near a source of fugitive dust that contains a large fraction of relatively massive particles. Using the relation of visual range in kilometers, equal to about 1800, divided by the average total suspended particulate concentration in $\mu g/m^3$ (Charlson, 1969), the minimum visibility on an otherwise clear day would be on the order of 25 kilometers (15 miles). This was calculated using an average particulate concentration of 70 $\mu g/m^3$ as representative of the entire air mass affecting visibility during the worst case predicted 24-hour total suspended particulates shown in Table EIII-2. Visibility degradation of this order is expected to occur with the same frequency as the maximum particulate concentrations, or about 19-30 days per average year. Presently the average visibility range over a year is estimated at 25 kilometers (15 miles). This estimate includes such factors as cloud cover, humidity, and background pollutant concentrations. Operation of the Energy Fuels mines will reduce this estimate to no less than 20 kilometers (12 miles) on an annual basis. Any incidents of coal fires in spoils could significantly reduce the above estimates of minimum visibility.

Living Components

Soils

Impacts on the soils would result from disturbance of 1,840 acres by Energy Fuels Corporation during the period of 1975-1979. There would also be a need to strip mine some 3,330 acres during the period 1980-1990 to meet desired coal production rates of five million tons/year. (Dames and Moore 1975).

Mining of the area would result in mixing together all existing soils within the mined area. The degree of redistribution of soils is unknown and would vary from place to place. This would change all soil characteristics, and alter micro-organism composition and other soil relationships that have been developed over geologic time.

In addition to soil acreage that would be disturbed by strip mining during the periods mentioned above, overburden would be excavated during the mining operation. The result would be a complete alteration of overburden characteristics, especially water movement over and through the disturbed layer; it could result in bringing geologic material to the surface that may be toxic to plants and animals. At the present time there has been no indication of discernible toxic materials in the soil or overburden other than low levels of sodium. At the completion of mining the soil structure and its properties would be completely different from those presently existing.

Disturbances would result in mixing of fine-textured soil material from the shale strata, and moderately coarse and coarse-textured soil material from the sandstone strata. The combination of these kinds of rocks exposed to weathering would produce a wide range of soil textures from sand to clay, in varying thicknesses and arrangements. These soil materials would be stony and difficult to work for seedbed preparation. Soil permeability and infiltration rates would be reduced through compaction, when the spoil is shaped and topsoil replaced for reclamation. This would increase runoff, thus increasing erosion and sedimentation. Wind action would cause some dust to be lifted into the atmosphere, reducing air quality and adding to soil loss. As all physical, chemical, and biological systems would be disrupted to an unknown degree, overall mining action would undoubtedly produce lowering of overall soil productivity.

Alterations of the channels of Middle and Fish Creeks in the area of the mines would affect downstream portions of these creeks and adjoining land. Channelizing stream courses would increase flow velocities, resulting in accelerated erosion of streambeds and banks. This would increase soil loss in the immediate area as well as along the downstream channels.

Mine facilities constructed outside the mined area would disturb and permanently remove soil from production.

Additional off-site soil impacts would result from increased population associated with mine employment. This increase would generate expansion of recreation and solid waste and sewage disposal, which would cause unquantifiable soil impacts such as compaction, erosion, sedimentation, water consumption, and decrease soil water quality.

Construction and mining equipment crossing undisturbed soil areas susceptible to compaction would impact soil permeability, water infiltration, and vegetative cover. This would increase runoff, erosion, and sedimentation.

Terrestrial Flora

There would be two main impacts on terrestrial flora associated with the mining operations at Energy Fuels mines: (1) total and partial destruction in the mined and otherwise disturbed areas, and (2) lateral effects on surrounding areas. Energy Fuel's mine plan is only complete to 1981; during that period vegetation on approximately 1,840 acres would be destroyed at mines 1 and 2. Vegetation would be destroyed as shown in Table EIII-3.

TABLE EIII-3

Vegetation Types, and Amount to be Disturbed (Acres)

Vegetative Type					
Sagebrush	Mtn. Shrub	Mtn. Shrub-Aspen	Aspen	Cropland	Total
880	195	85	20	660	1,840

Energy Fuels does not hold any Federal coal leases in Energy 3 area; however, approximately 80 acres of sagebrush have already been disturbed at this mine on a State lease. Also Energy Fuels anticipates that it will disturb approximately 3,330 acres from 1981-1990; however the areas that will be mined have not been delineated.

No additional roads will be required to obtain the coal from existing areas to be mined, but as new areas are developed, vegetation loss would begin with road construction. The mining operation itself would produce the largest impact on vegetation. The first disturbance of vegetation in the mining operation would result from stockpiling topsoil and placing boxcut spoils on undisturbed land. The mature mining operation would leave approximately 350 acres totally disturbed at any one time before revegetation begins. Total removal of vegetation from these acreages each year would have a secondary effect on surrounding vegetation. Once vegetation is removed from the mining areas and is unavailable to herbivors, vegetation on surrounding areas may be subjected to increased utilization. The magnitude of this impact would depend upon the importance of the area as wildlife forage, and the amount of overstocking of domestic livestock that takes place.

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Population increase associated with mine employment would disturb an estimated 156 acres of vegetation by 1990. Vegetative types removed are indeterminable, as the exact location of population cannot be determined at this time. This figure includes the development of social facilities (schools, shopping areas, etc.) to serve this increased population. Increased recreational use by the new expanded population, especially off-road vehicle use, would affect an indeterminable amount of additional vegetative types and acreages within the total study area.

Disturbance of areas currently used for cropland would probably be the smallest impact to vegetation, as Energy Fuels plans to replace topsoil and return these areas to cropland. However, the 660 acres of winter wheat that will be disturbed will be out of peak production for at least three years; assuming 30 bushels/acre, this represents a loss of 19,800 bushels/year. Since the fields are in summer fallow every other year, not more than two crops, or 20,600 bushels, will be the total crop loss. Because reclamation plans call for returning 400 acres more to dryland wheat than exists now, there should eventually be an increase of 12,000 bushels/growing season. Successful crops of shallow-rooted small grains would probably be easiest to re-establish on mine spoils, especially if a fertilizer program is included. Areas of native vegetation would be the most difficult to re-establish, if not impossible.

Another impact to vegetation during the mining operation would be the effects of fugitive dust and coal dust on plant life. It is difficult to predict the degree of impact produced by fugitive and coal dust, but it would probably be minor from fugitive dust, and it depends upon the cleanliness of the loading operation in relation to coal dust. Dust would result from haul roads, blasting, overburden removal, and spoil shaping. Dust that falls on plants might result in a decrease in plant vigor due to a lower photosynthetic rate. Dust covered vegetation might be less palatable and possibly toxic to livestock and wildlife; however this would likely constitute a very minor impact.

A secondary impact due to destruction of native vegetation is invasion of weedy species such as Russian thistle (Salsola kali). These weedy species would compete with revegetation attempts, thereby decreasing the chances of permanent vegetation establishment.

Energy Fuels plans to use alfalfa in their revegetation program. Alfalfa has been utilized in reclamation efforts in the area in the past and has been found to dominate the revegetated area (Berg and Barrau 1973). In dominating, the alfalfa provides an excellent soil stabilizer; however it tends to create a vegetative stand with very little variety for a number of years (at least ten), and produces management problems for domestic livestock (Berg 1975). It is current theory that the stability of a plant community is a function of its species diversity, and that succession in an ecosystem is described as a progression toward higher diversity (Kormondy 1969). Diversity produces stability, because there is less likelihood that any major shift or loss of any one component would adversely affect the system as a whole. It is evident from the increasing need of pesticides in agricultural croplands that most monocultures do not produce self-sustaining stable vegetation. Also Stewart (1974) found that micro-organism activity increased on revegetated mine spoils in southeastern Montana as

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species diversity increased; micro-organisms are very important to nutrient cycling and soil development.

The length of the impact of total vegetation loss would depend upon the success of reclamation. Since Energy does not plan to include native species in their seed mixture, the loss of the native vegetation would be quite long, depending upon the rate and ability of native species to invade the area, and the amount of shrub and tree transplanting done by the company. Also some small areas, due to soil texture, toxicity, or other factors, might be impossible to revegetate, making the loss of vegetation a permanent impact. Since current reclamation methods have been utilized for only two years, sufficient information is not available to predict the amount of time needed for native species invasion, or the extent of areas unable to revegetate. In some years climatic conditions may be such that revegetation attempts would fail, extending the impacts of vegetative loss. Also the loss of existing soil geomorphologic conditions and creation of a different soil might prove native vegetation difficult or impossible to establish.

Young, palatable vegetation produced by revegetation efforts would attract wildlife and livestock; grazing on young plants would inhibit early growth and revegetation of disturbed areas.

The total destruction of native vegetation from an area would result in the following impacts on the vegetation ecosystem:

1) Loss of above and below ground primary productivity,
2) Loss of a diverse vegetation capable of withstanding climatic extremes, and utilizing precipitation and sunlight throughout the growing season,

3) Loss of present vegetative successional stage, and a set back to a very juvenile stage,

4) Loss of a natural seed source, very necessary for ecological succession and stability,

5) Loss of nutrient cycling systems that utilize the soil, plants, micro-organisms, and physical forces to cycle nutrients from the soil to forms usable by plants. These systems are essential for self-sustaining vegetation growth, and might be the greatest limiting factor to establishing self-sustaining plant ecosystems on mine spoils,

6) Loss of soil stability and erosion prevention by roots and shoots of vegetation.

Terrestrial Fauna

Wild fauna

The expansion of Energy Fuels mine complex covered in this statement would result in several adverse impacts on a variety of wildlife species. Three major categories will be covered in this section: the mining operation, construction of support facilities, and reclamation activities. Each of these actions would impact the terrestrial fauna in its own particular way.

Mining operation

The major segments of a strip mining operation, as related to terrestrial fauna, are: exploration, removal of the vegetation, removal of the

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topsoil, removal of the overburden, and extraction of the coal. The first three segments of this type of operation would create the most significant impacts on wildlife.

During the exploration phase of the operation, paths would be cut through the existing vegetation and pad locations cleared; drilling operations would then take place.

Destruction of the vegetation would create impacts on the fauna by reducing the available nesting cover, escape cover, and food. The faunal species that are most affected would depend upon the vegetation type that is being disturbed. (Appendix D)

Noise resulting from the drilling operation and movement of equipment would create what is expected to be a short-term impact on those faunal species in close proximity to the work area; the noise could create a degree of anxiety in the animals. This degree of anxiety would depend on the faunal species, closeness to the operation, and the duration of the operation. Those animal species that are mobile enough, such as coyote, fox, deer, and most birds, would most likely leave the immediate area, at least temporarily. Those species that could not flee would probably retreat into their dens or other protective cover.

Some animal deaths would be expected from this phase of the operation from vehicle-animal collisions, and den or nest destruction, or disturbance. Unplugged core sample holes could create a hazard to small mammals, amphibians, reptiles, and invertebrates, and could result in larger animals, such as deer and elk, stepping into them and breaking a leg.

Removal of all vegetation would be the first step in the process of getting to the coal; the loss of this vegetation would result in a loss of food and cover needed by terrestrial fauna. The disruption of the mined portion of the ecosystem would be total. (See Appendix D for species affected by habitat type).

A combination of vegetation loss and removal of productive topsoil would leave the mined area void of animal life; this adverse impact would be exerted on all forms of terrestrial wildlife from soil mites to deer and elk.

The major impacts of the removal of the overburden and coal would be in the creation of the highwall, and the prolonging of the amount of time that the area will be disturbed.

The total loss of wildlife habitat would be in a constant state of progression across the lease area. Table EIII-3 indicates the proposed acreages that would be stripped by mines 1 and 2 from 1975-1979. An estimated 3,330 acres would be strip mined by the Energy Fuels mining operations from 1980-1990. This would make a total of about 5,170 acres that will be mined between 1975-1990.

There will be a one year time lag from the removal of topsoil to the beginning of revegetation efforts; this would mean that due to mining approximately 350 acres of land would be totally lost to all wildlife at any given time during this 15 year period. All previously mined areas would be in some stage of reclamation, and therefore provide some wildlife habitat value.

Additional acreage would be lost to wildlife as a result of road construction, mine facilities and the off-site loss of approximately 156 acres, due to the population increase related to the additional mine employees and support personnel. Most of the road construction and mine facility buildings are already completed for on-going mine operations. Therefore, additional losses of habitat resulting from these activities would be minimal.

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Less mobile faunal species such as many reptiles, invertebrates, and small mammals would not be able to flee and would be destroyed. The larger and more mobile species such as deer, elk, coyote, grouse, and other birds would be able to move onto adjacent lands. These displaced animals would be moving into a less suitable location, or an area that is already supporting populations that are in balance with their habitat. All or most of the displaced animals would probably be eventually lost, as the total population would begin to adjust to the carrying capacity of the species' habitat and the interspecific and intraspecific intolerances are resolved. The animals that have been displaced would be in unfamiliar territories; studies have indicated that most relocated wildlife species would be much more vulnerable to the affects of predation than if they had been able to remain within their home ranges. Probability of food and cover shortages, as well as the spread of disease and parasites, would also be increased as the population densities become greater.

The entire 5,170 acres that would be mined by 1990 provide summer deer habitat and winter elk habitat. Using the same population estimates used in Chapter II, habitat capable of supporting approximately 55 deer (estimated 21 percent of the subject area's herd), and 50 elk out of a local population estimated at 225, would be displaced and probably eventually lost. (See Figures EII-15 and EII-16). These animal numbers would represent a permanent loss out of the respective herds unless rehabilitation programs could restore the mined areas to an equal or greater carrying capacity than that which is presently available.

Impacts on bears and cougars would be expected to be significant to local populations. The degree of human activity as well as the loss of vegetal cover would probably preclude the use of the subject 5,170 acres by these species;

some of the adjacent lands would probably also become unsuited for these species because of the close proximity of human activity.

The most significant impact on the rabbits and hares would be the loss of food and escape cover during the mining operation; populations would decline in the limited area that has been denuded of vegetation.

Potential impacts to bats are not known although it is expected that these species would relocate.

In all probability the increase in human activity and the noise associated with the mining operations would cause some wildlife species such as coyotes, fox, and many birds to leave the working area prior to actual habitat destruction. The probability of an increase in vehicle-animal collisions would also be associated with the increase in human activity.

The probability of legal as well as illegal hunting and trapping pressure could increase as better access becomes available and more people come into the region.

Additional habitat destruction would likely result from business and recreational use of vehicles off the roads on lands adjacent to the proposed mined areas. This would cause a related reduction in the number of certain species of wildlife such as deer, rodents, and other herbivorous species, as the carrying capacity is reduced and nests and dens are destroyed.

Water quality has been altered in Fish Creek as a result of past Energy Fuels mining operations. Additional deterioration of this creek as well as potential damage to Middle and Foidel Creeks would be possible. This could result in making these creeks unsuitable for waterfowl, shorebirds, beaver, muskrats, amphibians, insects, and other wildlife species. (See Appendix D for a list of terrestrial species associated with aquatic habitats.) This loss would reduce the area's ability to sustain a balanced ecosystem similar to the existing one.

Approximately 10-20 percent of local sage grouse habitat would be altered; the expected impact would be a reduction of between 20-40 birds. Sharp-tail grouse and blue grouse would also be displaced, but no population estimates are currently available for these species within the mine complex. The area's carrying capacity for mourning doves would be reduced, as a result of a loss of vegetation until rehabilitation work begins.

A reduction in raptor nesting would be possible, resulting from human activity and potential loss of adequate nesting sites; however this loss is expected to be minimal. Noise emitted from the mining equipment and blasting would probably interfere with the raptor's hearing, thus affecting their hunting ability in close proximity to the ongoing mining operations. Some nestling gamebirds, raptors, shorebirds, and non-game song birds, would probably be destroyed as a result of the mining operations, because of their lack of mobility at this point in their life cycle. Many other birds would lose their nesting or escape cover and would cease to use the subject area.

Because of a lack of knowledge of the amphibian and reptiles species present, little can be said about the impacts on this segment of the terrestrial fauna. Most species of this group would not be mobile enough to escape destruction from the mining equipment; some species, such as rattlesnakes, would be killed by miners and recreationists in and around the actual mined areas.

Little is known of the species composition of terrestrial invertebrates; therefore nothing specific can be said about the impact upon them. Numbers would certainly decline in the mined areas until rehabilitation begins, but to what extent is uncertain.

Support facilities

No additional buildings are expected to be constructed, and no additional roads or powerlines have been addressed in the mining plan, although some limited construction could be expected. Some of the existing new roads have not been revegetated; they will continue to impact wildlife primarily by reduction of water quality due to sediment runoff during rains and snowmelt. Existing roads also impact wildlife by presenting the vehicle-animal collision hazard. This hazard would probably increase with expanded activity in the region.

Reclamation

The current land use plan of Energy Fuels is to revegetate much of the area that is presently a sagebrush, oak brush, and mountain shrub to grasslands or agricultural use. Animals that are closely associated with grasslands or domestic croplands would benefit from this change. At the same time those species that prefer the sagebrush, oak brush, or mountain shrub vegetation type would be detrimentally impacted. (See Appendix D for an indication of the species involved).

Energy Fuels has indicated that "Where possible, shrubs and trees will be relocated ..." (Energy Fuels Corporation Reclamation Plan). Exact size or configuration of these shrub or tree relocations has not yet been determined.

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However since the overall plan is to return most of the disturbed areas to grassland or crops, it is assumed that the shrubs and trees would not approach the total acreage that presently exists. Because the current revegetation plan does not call for replacement of all sagebrush, oak brush, and mountain shrub acreage, the initial decline in the deer herd would expect to be sustained. Elk habitat, mainly the food component, might be improved as a result of the revegetation effort; this appears to be the case in the older Energy Fuels 1 mine spoils.

All revegetated areas are to be fenced to exclude livestock grazing for the first two growing season; these fences may prevent some use by big game. If so, this would constitute an impact on deer and elk by restricting their use of the subject areas. Installation of protective fences and the mine's tall highwall would create a barrier to normal animal movement. The impact of the highwall would be greater on small mammals, reptiles, and amphibians than on the larger, more mobile animals such as deer, elk, and coyotes. An additional impact would be the loss of life due to animals falling off the highwalls or getting entangled in the fences.

Based on past reclamation projects, the early stages of this project would probably support abnormally high rodent numbers. The species composition and densities of these rodents would vary, dependent on successional stages of reclamation and the plant species used in revegetation; it is unlikely that the species composition would return to its pre-mined status. High rodent numbers are expected to attract and sustain larger than normal numbers of predators, mainly coyotes, fox, snakes, and raptors.

Jackrabbit populations would be expected to make a rapid recovery in areas where herbaceous cover has become successfully established. Cottontails and snowshoe hares would not respond to rehabilitation efforts to a significant degree until brush and tree species were replaced.

Sage grouse and blue grouse numbers would not be expected to recover because of the loss of their preferred habitat -- sagebrush and aspen. Mourning dove prefer to feed in weedy fields. If the revegetated areas are invaded by seed producing weeds, overall dove use would increase.

The degrees of invertebrate recovery from the impacts of the mining operation would depend entirely on the vegetal species composition and success of the revegetation program.

Domestic fauna

All livestock would be moved out of the proposed mine areas prior to beginning actual work; no livestock are expected to be destroyed by these activities.

Approximately 1,400 acres of land would be totally lost to livestock at any given time during the mining operation; the resulting loss of Animal Unit Months (AUMs) would vary depending on the vegetation type being cleared. All previously mined areas would be in some stage of reclamation. All revegetated areas would be fenced to prohibit livestock grazing for a period of two growing seasons.

Losses in AUMs, on a year by year basis, could vary from 270-139, depending on the type of vegetation disturbed. Assuming actual livestock use for four months, as many as 35-68 cattle or 175-340 sheep will be displaced.

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TABLE EIII-4

Carrying Capacities and Loss of Animal Unit Months by Vegetation Types during First Five Years of the Mining Operation

Vegetation Type	Carrying Capacity in acres/AUM	Acres Disturbed	Total AUMs Lost
Aspen	4.00	20	5
Aspen - Mt. Shrub	4.25	85	20
Sagebrush	7.75	880	113
Mt. Shrub	4.50	195	43
Cropland	7.00	660	94
Total	-	1,840	275

TABLE EIII-5

Estimated Carrying Capacities of Revegetated Areas at the End of the First Five Years of Mining Operations

Vegetation Type	Carrying Capacity in acres/AUM	Acres Revegetated	Total AUMs Restored
Grassland	3.00	780	260
Cropland	7.00	1,060	151
Total	-	1,840	411

In the current reclamation plan, Energy Fuels would reseed with a mixture of grasses and alfalfa. Alfalfa on mine spoils has caused livestock losses in other areas in northwestern Colorado. Planting this species could result in loss of animals due to bloat when they are eventually returned to the revegetated areas.

The reclamation plan also calls for a conversion of the lands in the Energy 2 area to agricultural use; these lands would be lost to livestock grazing for most of each year.

Table EIII-4 indicates that approximately 1,840 acres, representing 275 AUMs, would be altered during the first five years of mining. Approximately 780 acres would be put into croplands; the remaining 1,060 acres would be seeded to a grassland type. By substituting carrying capacity figures used in Table EIII-5, there will be an expected net increase of 136 AUMs after all mined areas have been revegetated and vegetation has become established. This indicates a potential beneficial impact for livestock.

Aquatic Biology

Increase in sedimentation which would result from the proposed mining activities would have a severe effect on the aquatic ecosystems in the Trout Creek watershed. Surface mining methods such as those employed at Energy 3 mine (Figure EII-11) could result in a "dead stream" for miles below the action site. Drastic sedimentation increase resulting from disruption of natural stream channels would result in: (1) reduction of all benthic (bottom) organisms by suffocation, resulting from increased deposition of silt in the streambed, (2) silting in of all riffle areas which are critical to trout spawning and

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feeding, (3) elevation in water temperature and a decrease in dissolved oxygen content of the stream, to an extent that would produce an intolerable environment for trout, (4) an increase in disease and suffocation in fish due to abrasive and clogging effects of additional sediment on their gills.

Direct alteration of the natural stream channels as a result of strip mining activity could also eliminate aquatic life in the stream at and below the site through dessication. If natural streamflow is diverted during mining operations for a period of more than 24 hours, all aquatic invertebrates and plants in the streambed would perish. In addition, fish present in this stream segment would either have to migrate into already occupied habitat further downstream or perish. Total recovery of the aquatic ecosystem from complete streambed desiccation of this nature would require a matter of years following the resumption of streamflow. Mining activities across a stream channel would also eliminate riparian vegetation which is critical to both local fish and wildlife populations. Critical habitat areas (spawning beds) would be permanently removed from the ecosystem. Natural flow characteristics of the stream would be changed, resulting in permanent alteration of habitats and life cycles of many members of the aquatic community; for instance, an increased stream velocity resulting from channelization would alter the pool-riffle ratio of the stream channel, producing corresponding shifts in trout habitat use areas. An increased stream velocity would also change the composition of the macroinvertebrate population, resulting in a preponderance of organisms which can adjust to the swift currents by permanently attaching themselves to the stream bottom.

Effects of strip mining on the aquatic community could extend throughout the Trout Creek drainage. For example, fish displaced by mining activities would have to migrate downstream into already occupied habitat. Such displacement of the members of fish population could result in overpopulation of the downstream habitat (not enough available food and cover for the number of fish present), stunting (fully grown fish with extremely small bodies and large heads), or death.

Cultural Components

Archeological Resources

Total projected acreage disturbance for Energy Fuels by 1980 is 1,840 acres; by 1990 an additional 3,330 acres would be disturbed (5,170 acres total). Because Dr. Olson's analysis of the Energy Fuel's area was only a reconnaissance survey, unknown sites could be destroyed by this acreage disturbance, and by vandalism or pothunting. Projected employment figures for Energy Fuels are 137 employees by 1980, 306 by 1985, and 418 by 1990. Table EIII-6 shows the likely impact on the known sites.

TABLE EIII-6

Impacts to Cultural Resources

Site No. (see Figure EII-20)	Nature of Probable Impact		
	Direct Physical Displacement		
	Mining	Roads and R/Ws	Vandalism
1		x	x
2		x	x
3		x	x
4[1/] [2/]	x	x	x
5[1/]	x	x	x
6[1/]	x	x	x
7		x	x
8			x

[1/] On or in close proximity to competitive lease application C-22677

[2/] Number four's National Register qualities would be adversely impacted by mining or disturbing the site area.

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Because the Energy Fuels mine plan lacks specificity with respect to support facilities, roads, and rights-of-way, only the general nature of impacts can be assessed in this section.

Historical Resources

As the Foidel School is in an area of ongoing operations, impacts to it would not be expected in the form of direct physical displacement. Because no intensive cultural resource survey has been completed, potential vandalism, pothunting and outright physical displacement of unknown historical features could occur. Mining operations in the Pinnacle Peak area could adversely impact the two graves (see Chapter II) in that area, depending upon the exact location of the graves. Their cultural integrity may also be adversely impacted by constructing protective fence exclosures, though this would discourage actual physical destruction.

Aesthetics

Areas to receive the greatest impacts will be those where proposed actions do not borrow form, line, color, and texture (visual dominance elements) from the characteristic landscape. In other words when the dominance elements inherent in the proposal do not complement those of the landscape into which the proposal is to be placed, it will not "fit" and is therefore labeled a minus deviation.

By referencing the landscape visibility maps (Chapter II), and the proposed action areas (Chapter I), the areas having the greatest potential for adverse impact may be identified.

In terms of distance, the most sensitive areas are foreground visual units and the least sensitive are background units; this can be read directly from the landscape visibility maps.

When landscape visual units are viewed rather obliquely, their portion of the total picture plane is relatively small. When viewed more directly (at a greater viewing angle), the picture plane size increases in scale and so do the minus deviations that occur there. This can also be read from the landscape visibility map by referring to: (1) contour alinement (aspect), and (2) contour spacing (slope), both with respect to the viewshed sequence that provides visual access to the particular landscape visibility unit in question.

A greater potential for adverse impacts also occurs when landscape visual units: (1) may be viewed from more than one road segment (viewshed sequence), (2) are viewed for a greater distance along those viewshed sequences, and (3) lie at different distances when visible from more than one viewshed sequence. This also can be read directly from the landscape visibility maps.

The largest-scale elements in the landscapes containing proposed action would be the coal stripping areas themselves. However most of the minus deviations resulting from a coal stripping operation result from roads and linear rights-of-way that would be attendant to the proposed action itself, because they cover a larger geographic area and are also relatively permanent fixtures.

The characteristic landscape's visual dominance elements include the rolling to angular form of grass and sagebrush hills that blend into woodland and aspen types at higher elevations. At Energy 1, rimrock escarpments provide an added dimension of horizontal form; agricultural lands dominate the view at Energy 2.

The form of the stripping areas would conflict with irregular patterns occurring naturally, though they can more easily borrow from the somewhat

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rectangular agricultural pattern at Energy 2 and 3. Within the stripping area, spoil piles produce a repetitious form of sharply angular ridges that are minus deviations in this rolling landscape. The active pit and adjacent highwall introduce additional linear form that is foreign in this characteristic landscape. Where spoils are dumped over escarpments, they produce barren talus slopes whose vertical triangular form is foreign to the horizontally-oriented rectangular form of rock ledges.

Cuts and fills on roads and rights-of-way characteristically produce half-moon shaped scars that can only borrow form from adjacent rimrock escarpments. When viewed parallel to their alignment, their sharply angular contact with natural terrain fails to borrow form from the adjacent rolling landscape.

Buildings, tipples, and draglines further introduce sharply angular form into the landscape.

Line in the Energy mine area is typically seen as an undulating silhouette in ridgetops, and as a curving horizontal arc seen in rock escarpments. Line-dominant proposals that do not complement these elements in close proximity to their natural occurrence cannot borrow from them. Power transmission structures and conductors, buildings, equipment, tipples, roads, and rights-of-way are strongly line-dominant elements difficult to screen in this landscape. Specifically the Keystone-Energy 69-kv transmission line reroute would constitute a large-scale minus deviation immediately adjacent to County Road 27 on viewshed sequence EF at Energy 1. Other minus deviations include transmission lines and a substation adjacent to viewshed sequence NO at Energy 3.

Like straight roads, rechanneling of streams could produce strong line dominance that does not complement curving lines of hillsides and meanders.

Silhouettes produced by spoil piles, transmission lines, draglines, and vegetation clearings have conspicuously incongruous angular lines that most commonly appear on ridgetops where undulating lines are characteristic; these minus deviations also occur when strip mining components are viewed at low angles. When viewed from higher angles (i.e. more directly), vegetation clearings whose edges are straight, can, like spoil banks themselves, become strongly line-dominant minus deviations.

Naturally occurring colors include the green, yellow, and brown earth tones. Large stripped areas result in color variations that draw attention to the stripping operation. Generally these are other earth tones that do not complement colors in the adjacent landscape. The coal visible in the active pit and barren cut-and-fill slopes are respectively dark and light-colored minus deviations from the characteristic landscape. Changes in the vegetative complex upon reclaiming surface disturbances can also result in natural hues markedly different from the characteristic landscape. Reflective or silver colored tipples, transmission lines, and buildings introduce foreign colors into the characteristic landscape, as does brightly painted equipment.

A variety of textures results from the different vegetative types in the Energy mine area. However reclamation efforts that utilize other than native species would create textural differences from the adjacent types. Spoils, road cuts, and rights-of-way that are not successfully revegetated would appear as minus deviations also.

Road and blasting dust, coal dust, and exhaust emissions create short-lived landscapes foreign to the native surroundings. Other ephemeral landscapes that occur as minus deviations would result from increased siltation in streams.

If vegetation that is cleared during road construction or in connection with the mining operation itself is scattered adjacent to the disturbed areas, or if it is piled and burned, it will produce an aesthetically unconforming landscape of forest litter.

Disposal of refuse and waste from the mining operation could also produce an undesirable landscape of litter if it is not visually screened and properly maintained.

The foregoing discussion of minus deviations accruing to the proposed action is with respect to the characteristic landscape into which they are being placed. Existing coal mining operations have already produced a variety of existing minus deviations (see Chapter II) prior to those adverse impacts described herein.

Overall aesthetic experience at Energy mine areas would also be adversely impacted. Descriptions of mood-atmosphere reactions are subjective and vary from one person to another. Though few of the proposed action areas can provide feelings of isolation or solitude (due to adjacent ongoing mining operations), they may kindle a certain respect for nature. The proposed action might both adversely and beneficially impact this inspirational quality either by disturbing the landscape's natural integrity (adversely), or by revealing the complexity and massiveness of nature's grandeur (beneficially).

Recreation

Adverse impacts might accrue to the area's wildlife viewing potential if critical habitat is mined. Mining operations in too close proximity to such habitats might also drive intolerant species from their habitats. For example, viewing opportunities at sage grouse strutting grounds adjacent to Energy 2 might be lost. Also one unit of competitive lease application C-22677 contains a sharptail dancing ground.

When mining operations, roads, or rights-of-way occur on steep slopes, or in too close proximity to perennial streams, increased sediment loads would occur in either Fish, Foidel, Middle, or Trout Creeks. Stream diversions for use at mines could lower streamflows, especially during dry periods, and thus to destroy aquatic habitat. Rechanneling and relocation of drainages also might promote siltation. These changes ultimately impact the recreation supply in terms of each stream's capability to attract and support fishing use. Essentially all Energy lease applications and existing leases would have potential for causing these impacts. Downstream siltation at Energy 3 and incidences of increased streamside erosion at Energy 2 are witnesses to these impacts (see Figure EIII-5).

Dumping overburden over escarpments could create safety hazards for recreation visitors and sightseers on public roads below them. Several large rocks have crossed County Road 31 after having fallen from overburden that was dumped into Middle Creek drainage from the Energy 1 operation (see Figures EIII-1 and EII-30). Unknown archaeological sites might be destroyed by mining operations and thereby lose their inherent capability to attract and accommodate recreation use. This loss could occur through actual destruction of the resource by mining itself, either by direct removal, or by off-site influences such as seismic damage from blasting, or through vandalism and pot hunting by mine employees. Present employment is 175; projected employment by 1990 is 418.

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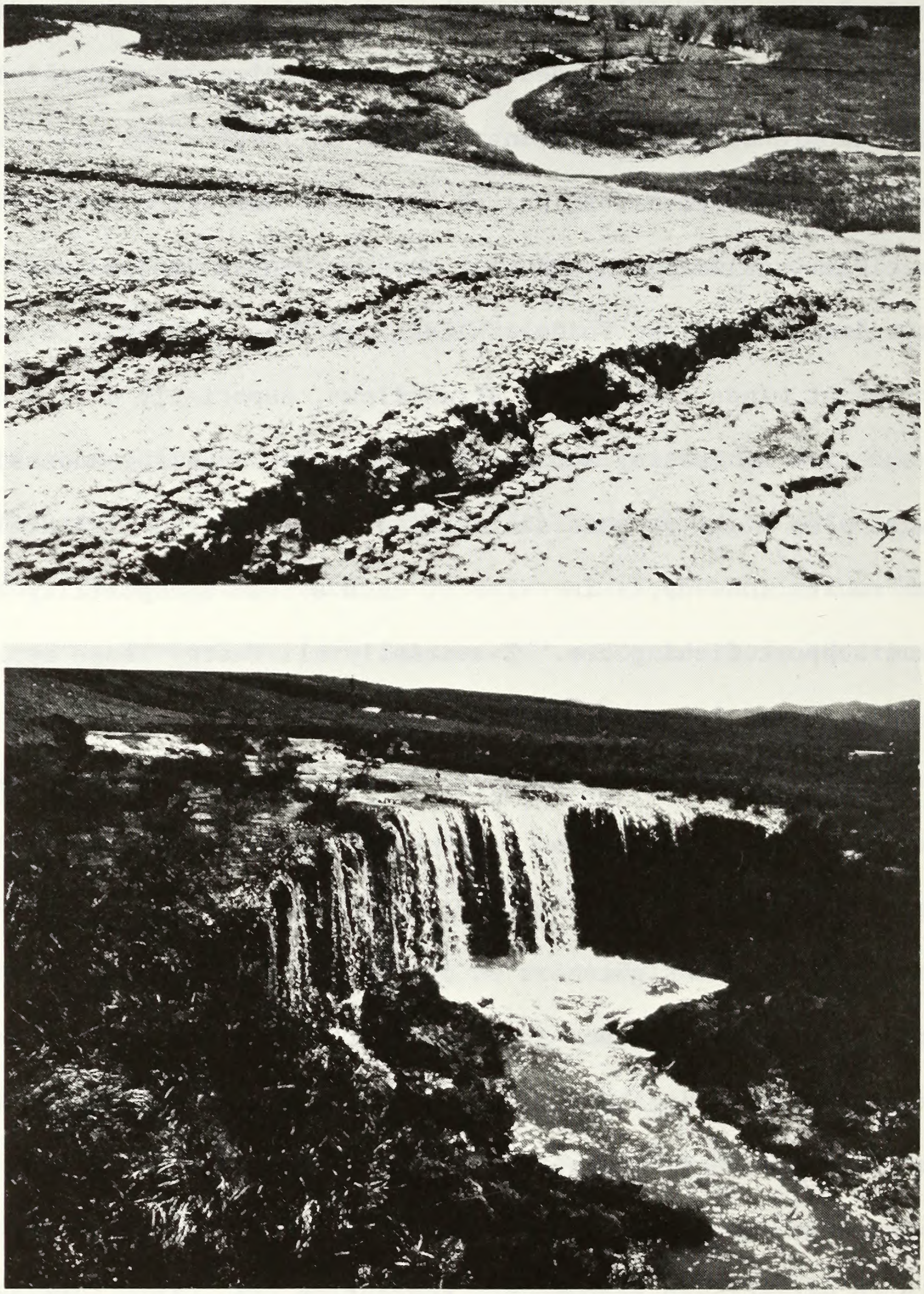

FIGURE EIII-5

Examples of impacts to the recreational capabilities of downstream fisheries are illustrated by these sediment-producing actions at Energy 2 adjacent to Fish Creek The top photo shows rill erosion on partially reclaimed spoils (photo's lower half) plus gullying from an uncontrolled water diversion (upper half). The lower photo is a closer view of erosion from the uncontrolled water diversion.

Developments at Energy 2 might adversely impact the recreational potential of the private big game hunting area Green Acres for any of the above reasons. No other public nor private hunting areas occur adjacent to or on the Energy mine proposed action areas that would suffer recreational losses due to any actual displacement of wildlife species. However this adjacent recreation operation might actually realize beneficial impacts of the proposed actions through experiencing a net increase in numbers of animals. This is presently the case adjacent to and east of Energy 2 mine (Scott 1975).

In addition revegetation efforts on mined-over areas might result in beneficial impacts to wildlife viewing by attracting more animals; this is presently occurring with winter elk concentrations at Energy 1 spoils.

More roads, trails, and denuded slopes could also positively affect the area's capability to attract and support off-road-vehicle (ORV) use. Beneficial impacts would accrue to snowmobiling in winter and to trail bikes in summer.

Other beneficial impacts might be the increases in each mine's capability to attract and sustain rockhounding use. Stripping of the overburden would uncover interesting and collectable rocks and fossils now found below the surface.

Greater capabilities for geologic and industrial interpretation would also be beneficial impacts. All three mines have existing public access viewpoints (see Aesthetics Section) with potential for informing the visiting public of the physical and economic conditions conducive to strip mine development on these particular sites. This could be accomplished by interpretive signing, interpretive-educational brochure development, and also by guided tours.

Social Environment

Table EIII-7 presents population impact by county and community of the development of Energy Fuels mine; it also indicates expected new school enrollment by county. These data were generated by the gravity-employment multiplier model described in Chapter IV of the Regional Analysis (Future Social Environment Without the Proposed Action). They represent incremental increases over and above the base scenario presented in the same section of the Regional Analysis.

Requirements for new social support facilities including housing, health care, education, water and sewage treatment, fire protection, and law enforcement are functions of increases in population. Table EIII-7 indicates that expansion of the Energy Fuels mine would induce a relatively moderate increase in population; therefore, impacts on existing social support facilities are expected to be relatively small compared to both the existing extent of and other future demands on these facilities. It is the cumulative impact of several new developments that generates significant new requirement for social support facilities; these requirements are addressed in depth in Chapter V of the Regional Analysis.

Population projections show that the Energy mines would cause an increase of about 600 people in Moffat County and 950 in Routt County by 1990. This means that approximately 60 acres will be needed in Moffat County for residential and community facilities. Most of these uses will be on lands in and around Craig. However there is a possibility that some new rural residences along good county access could become established.

TABLE EIII-7

Population Impacts of Energy Fuels Mine Development

	1980	1985	1990
Direct Employment at mine*	137	306	418
New Population			
Moffat County total	157	433	608
Craig	157	433	608
Routt County total	341	694	949
Hayden	46	117	168
Oak Creek	106	203	273
Steamboat Springs	155	307	420
Yampa	34	69	88
Total	498	1127	1557
New School Enrollment			
Moffat County	33	87	309
Routt County	69	139	189
Total	102	226	309

* Over and above existing employment

These would have to comply with local zoning and ordinances. In Routt County an additional 95 acres might be needed to accommodate the expected population growth. Most requirements will be met by Steamboat Springs, Oak Creek, and Hayden. As in Moffat County, additional rural residences may be expected closer to the mining areas. These would probably be for a portion of the actual work force at the mines. Although it is possible, it is doubtful that new communities or subdivisions will be built to handle the housing needs of the 418 new employees.

There have been no expressions of local attitudes specifically oriented toward the development of the Energy Fuels mine. Rather attitudes are directed toward the subject of regional and community growth in general (and are therefore examined in the Regional Analysis).

For a more extensive analysis of the regional impacts, mitigations, and unavoidable effects to which the expansion of Energy Fuels' mines would contribute, refer to the appropriate chapters of the Regional Analysis.

Economic Conditions

Table EIII-8 presents the economic impact of development of Energy Fuels mine in terms of employment and earnings. These data were generated by the gravity-employment multiplier model described in Chapter IV of the Regional Analysis (Future Economic Environment Without the Proposed Action). These data represent the incremental impact over and above the base scenario described in the same section. Note that in each of the benchmark years, the greatest induced employment and earnings impacts from the Energy Fuels mine development fall in Routt County.

TABLE EIII-8

Economic Impacts of Energy Fuels Mine Development

	1980	1985	1990
Direct Employment at mine*	137	306	418
Induced Employment			
Moffat County	34	84	135
Routt County	67	137	186
Total	101	221	321
Direct Earnings	3066	7653	11725
Induced Earnings			
Moffat County	340	1097	1548
Routt County	686	1556	2388
Total	1026	2653	3936

Note: Earnings data in thousands of 1974 constant dollars.

*Over and above existing employment levels.

No adverse economic impacts are expected to be associated with the development of Energy Fuels mine because both the direct and induced employment and earnings are relatively small compared to the economic base of the region. Also, of the current employees over seventy percent are long-term Routt County and Colorado residents.

Transportation Networks

Highways

Since all new coal output is to be transported via the Energy spur, and thence via D&RGW rail lines out of the area to Pueblo, no impacts in the form of increased coal truck traffic due to these increased operations are expected. Since rail lines go directly into the mining areas, equipment need not be transported over the highways.

Increased use of the Energy spur and the D&RGW lines by coal trains and equipment might result in increased hazards at road crossings. Some crossings may be in need of upgrading to minimize hazards and allow crossing of the rail lines by local automobile traffic. There are three of these crossings along the Energy spur. One is located 12 miles along the spur from Milner near Energy Fuels 1 site, which has been eliminated by a nearly completed traffic overpass. The other two are still grade crossings protected by signs only, located 5 and 11 miles down the spur from Milner. No major highways are involved; all are county roads carrying local traffic.

Railroads

Total production of coal is to be moved by rail through the tipples at Energy 1 and 3.

The coal would be loaded on a 280 day/year schedule using 46 or 58 (100 ton capacity) car unit trains, without helper service. This amounts to about 3 unit trains of 58 cars/day, or 3-4 unit trains of 46 cars/day, each way. The impact of this number of trains to be loaded and run over the Energy spur would probably necessitate careful scheduling. Proper scheduling of traffic over the D&RGW branch line with which the spur connects would also be necessary to work up to 4 coal trains/day (280 days/year) into the regional rail traffic. The actual increase would be from a present production of 2.5 million T/yr to 4.5 million T/yr. Using 46 car unit trains, this would be an increase of 1.2 trains/day to be inputted to the D&RGW Craig branch line.

Increases of levels of various pollutants affecting air and water quality are considered under the appropriate headings in this chapter. These increases could be expected due to increased coal transport as well as increased coal loading.

Noise levels could be expected to go up due to the operation of more trains over the Energy spur from increased coal production.

Airlines

The only real effect that the initiation of increases in Energy Fuels mining and railroad operations could have is increased passenger loads into the Yampa Valley Airport at Hayden. Since this airport is now undergoing a ten million dollar improvement operation, any increases due to the Energy Fuels mining plan should be easily absorbed by the improved airport facility. Some increase in passenger traffic into the closer Steamboat Springs Airport could also be expected; however, services are more limited there.

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Chapter IV

Mitigating Measures

THIS CHAPTER PRESENTS MEASURES THAT WOULD LESSEN OR ELIMINATE THE ADVERSE IMPACTS OF ENERGY FUELS CORPORATION'S PROPOSED ACTION. THESE MEASURES ARE DISCUSSED IN THREE CATEGORIES: THOSE INCLUDED IN ENERGY FUELS CORPORATION'S PROPOSAL, THOSE REQUIRED BY LAW OR REGULATION, AND THOSE MEASURES THAT WOULD BE APPLIED AS SPECIAL CLAUSES OR STIPULATIONS TO LEASES OR PERMITS. IN EACH OF THESE CATEGORIES, MEASURES ARE PRESENTED BY IMPACTED ENVIRONMENTAL COMPONENT. BECAUSE SOME MEASURES LESSEN IMPACTS TO MORE THAN ONE RESOURCE, SOME REPETITION OF MITIGATIONS IS UNAVOIDABLE. ALL MEASURES ARE ASSESSED AS TO THEIR PROBABILITY OF IMPLEMENTATION AND/OR SUCCESS. MITIGATING MEASURES ARE PRESENTED AND ANALYZED AS PROCEDURES THAT WOULD BE REQUIRED IF THE PROPOSED ACTION IS APPROVED.

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CHAPTER IV

MITIGATING MEASURES

Measures Included in Applicant's Proposal

Water Resources

Impacts on water resources would be lessened by pumping water accumulated in the mined area into settling ponds before allowing it to enter the natural drainages.

Air Quality

Impacts on air quality would be reduced by revegetation and road watering as proposed in Energy Fuel's reclamation plan.

Soils and Terrestrial Flora

The following mitigating measures included in Energy Fuels mine reclamation plan deal with each mining area separately, followed by measures that apply to all sites.

Energy 1 mine

The proposed use for this area after mining is grazing land for wildlife and domestic livestock. Spoil piles would be reshaped with track-mounted dozers to approximate original contours after there are two overburden piles separating the reclamation area from the mining cut, so areas of disturbance is kept to a minimum. Shrubs and trees would be relocated with a front-end loader, from areas to be mined to areas which are being revegetated. Energy Fuels Corporation is also reclaiming the spoils from the old mining operation; this consists of leveling and reshaping the spoils to approximate original contour, and replacing topsoil to a depth of four-six inches if sufficient topsoil is available in new areas. The area is then disced, harrowed, and reseeded. Trees and shrubs will also be transplanted to this area.

Energy 2 mine

The proposed use for this area after mining is cropland, primarily for production of small grain crops. Overburden shaping would be done in the same manner as Energy 1, except where overburden is shallow and removed by scrapers; in these operations spoil material would be placed in its final shape by the scrapers.

Energy 3 mine

This area will be reclaimed to either farmland, or grazing land for wildlife and livestock depending upon site specific conditions, mostly topography.

Since the pullback mining method will be utilized at the mine, all topsoil will be stockpiled. After the coal has been removed, overburden will be replaced by trucks or scrapers and only a minimal amount of regrading will be required.

Practices utilized at all mines

Shaping would be accomplished in a manner which would blend the reclaimed land with the surrounding natural topography as much as possible; this would allow runoff to be spread evenly over the mined area, and lessen the possibility of soil loss by water erosion. Time lag between stripping and reclamation would be approximately one year, to keep the area of disturbance to a minimum, and allow revegetation efforts to be accomplished at optimum seeding times.

Reshaping of the spoils would be accomplished with tractors and scrapers, and topsoil would be replaced with rubber-tired scrapers, so soil mixing would be minimized. Grade stakes would be used to facilitate topsoil depth measurements. Topsoil would be smoothed with tractors using drag chains and rail ties. It would be disced or chiseled to create a suitable seed-bed, and then harrowed. The degree of leveling and roughing would be determined by use; for example, on land reclaimed for grazing it might be desirable to rough the surface more to create a diverse microclimate for a better vegetative cover. However, leveling of replaced topsoil on land reclaimed to farmland would be very desirable and necessary to produce a favorable surface for crop production. Topsoil would be removed from areas to be mined and applied directly to areas to be reclaimed where feasible. It would be stockpiled when the mining sequence, or soil moisture and temperature conditions do not permit immediate placement. When it is stockpiled, it would be segregated from any spoil material; furrows would be constructed at the slope toe to prevent possible water contamination. Topsoil piles would be roughened and seeded with a fast-growing plant to facilitate moisture retention and decrease erosion and nutrient leaching.

Seeding to a depth of one-half to three-fourth inch would be accomplished with a drill where topography is amenable to farm machinery. At present the following species are planted on all affected areas: intermediate wheatgrass (*Agropyron intermedium*), smooth brome (*Bromus inermis*), orchard grass (*Dactylis glomerata*), and alfalfa (*Medicago sativa*). Seeding rates of 8:4:2:2 pounds pure live seed/acre would be used; on broadcast-seeded areas these rates would be doubled. Additional and/or alternate species would be utilized as site, use, and supply indicate. Seeding would be conducted preferably in fall or early spring. Where reclamation is to achieve range type conditions, native shrubs and trees would be transplanted with a front-end loader, and/or by hand when species are dormant. Planting of some introduced trees and shrubs would be conducted on a site specific basis.

It is anticipated that mulch would not be required on most surfaces to be reclaimed; hydromulching might be used on areas with steep slopes, but they would be minimal.

Experiments with wood chips and straw would be conducted on small tracts to facilitate planning for mulch on areas of adverse soil and/or moisture conditions.

Soil samples would be taken randomly on sites that have been reshaped and topsoiled. These samples would be submitted to the soil laboratory at Colorado State University for analysis and fertilizer recommendations. Recommended fertilizer would be applied in early spring following the first growing season. If weeds invade areas reclaimed for cropland, control would be conducted by either mechanical or chemical methods, depending on the area and severity.

No overburden bore holes have been sampled to date, but plans are being made to sample and analyze strata during summer, 1975. The results of these analyses would be helpful in determining the best methods for overburden segregation if required.

All overburden shaping would be accomplished on a slope calculated to minimize erosion and sedimentation, prevent landslides, and control flooding. Furrows would be contoured at the slope toe of topsoil and overburden piles to trap sediment.

All toxic material, debris, or refuse would be buried in the pits in a manner to prevent contamination of ground or surface water.

All haul roads would be watered to control fugitive dust, in compliance with air pollution standards set by the Colorado Air Pollution Control Commission, and would thus reduce the impact of fugitive dust on soils and vegetation.

All reclaimed areas would be fenced with a livestock-proof fence. These areas would be restricted to grazing until after the second growing season, at which time grazing would be permitted on a limited and regulated basis with the approval of the Open Mine Land Boards recommendation. All appropriate governmental and private agencies would be consulted as necessary to accomplish the best possible and most economical reclamation.

Terrestrial Fauna

Energy Fuels has stated that the primary use of the proposed mine site, after mining, would be for domestic livestock grazing and wildlife use. The area would be reseeded, and trees and shrubs would be transplanted. These actions would help mitigate the loss of wildlife habitat by returning a vegetal cover to the area as soon as possible.

All reclaimed areas would be fenced to exclude domestic livestock until after the second growing season. This would help mitigate losses of forage by allowing the reseeded and new planted areas sufficient time to establish a vegetation community that would support faunal use.

Energy Fuels would continue ongoing wildlife monitoring programs to provide additional information to assist in mitigating potential wildlife impacts.

In an effort to minimize the impacts of the mine's disturbance, reclamation work would be concurrent with the mining activity; reclaimed acreages would equal disturbed acres each year.

Aquatic Biology

The four streams in the proposed mining area would be monitored monthly, as weather permits, above, below, and within the mine areas. Any surface water generated into the pits would be pumped into evaporation ponds. These two actions would help mitigate potential impacts to the aquatic ecosystem.

Aesthetics

Large-scale form, line, and color-dominant minus deviations would be mitigated by complete regrading of the spoils (at Energy 1 and 2 -- and replacing with trucks and scrapers at Energy 3), and by revegetation. In the mature operation, the reclamation operation at Energy 1 and 2 would lag two spoil ridges behind the active pit operation. At Energy 3, no reclamation would begin until the coal is removed from the entire seam exposure.

Establishment of vegetation to mitigate visual impacts of color and texture-dominant minus deviations would occur approximately three years after spoil pile leveling and seeding. Planting of trees and shrubs is proposed at Energy 1, which if successful would further enable the area to blend with the characteristic landscape. Reclamation for cropland at Energy 2 would enable the mined-over area to borrow form from the adjacent forming landscape.

All toxic material, debris, and refuse are to be buried in pits. This would help ensure the maintenance of a litter-free landscape.

All haul roads would be watered to control fugitive dust; however it should be noted that this type of control is only approximately 30 percent efficient.

Recreation

Energy Fuels proposes to regrade all spoil piles, and subsequently to establish either grassland or cropland vegetation. This action would significantly reduce mine-caused downstream siltation, which would help maintain downstream fishing capabilities in Fish, Middle, Foidel, and Trout Creeks, as well as in the Yampa River.

Measures Required by Law, Regulation, or Stipulation in Applicant's Present Lease

Laws and regulations common to all proposed mine developments grant the Secretary of the Interior, the Environmental Protection Agency, and the Colorado Department of Natural Resources authority to impose measures that will mitigate adverse impacts on the natural and human environment; they are listed in Chapter VI of the Regional Analysis. The following mitigating measures are required of Energy Fuels.

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Paleontology

On July 10, 1963 the Regional Solicitor at Salt Lake held

> "that fossils are covered by the Antiquities Act but such coverage extends only to such fossils which are of an actual and real historic or scientific interest and of some unusual significance."

(Associate Solicitor, Division of Public Lands, October 13, 1971).

Title 43 CFR6010.2(b)(2) prevents removal of

> ". . . or object of antiquity, historic, or scientific interest."

However, Section 6010.2(2) does allow for collection of common invertebrate fossils, rocks, and gem stones for personal use, consumption, or hobby collection.

Air Quality

Impact on air quality as a result of mining and associated operations is affected by the following laws, regulations and guidelines dealing with air pollution.

1) National ambient air quality standards promulgated by EPA for suspended particulates, hydrocarbons, nitrogen oxides, sulfur dioxide, carbon monoxide and oxidants (EPA 1971).

2) Ambient Air Standards for the State of Colorado, sulfur dioxide and suspended particulates (Colorado 1970).

3) Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulfur Oxides for the State of Colorado, Section II. D. Fugitive Dust (Colorado 1971).

4) Clean Air Act, 1970, Section 110, State Implementation Plans, Prevention of Significant Air Quality Deterioration (EPA 1974b).

5) Clean Air Act, 1970, Section 110 State of Implementation Plans, Air Quality Maintenance Areas and Plans (EPA 1973b).

Of these, the first three are existing regulations governing air quality and emissions; the last two are EPA requirements and guidelines that will probably lead to emission regulations in the next several years.

Under the State of Colorado Implementation Plan for achieving air quality standards, the State has enforcement responsibility for all five listed existing or future regulations.

The State Ambient Air Quality Standards are more restrictive than the Federal standards promulgated by EPA for suspended particulates and sulfur dioxide. These and the Federal standards for the other gaseous pollutants will apply to all areas outside the mine property.

Emissions of particulate matter, as well as ambient air concentrations of suspended particulates, are controlled by Colorado law. Ambient air standards are not specific to a source, while emission standards apply directly to each individual emission point and may be different for each source. Enforcement of emission regulations is independent of ambient air pollutant concentrations and thus does not necessitate distinguishing between contributions of several sources. The fugitive dust regulations referenced above in number 3 prohibit mining operations without a permit that specifies fugitive dust control measures. The following excerpt from page 1.19 of Regulation No. 1, Section 9, indicates some of the control measures that may be required.

9. List of Abatement and preventive Measures.

b. Demolition, Wrecking and Explosive Detonation Activities; Earth and Construction Material Moving, Mining and Excavation Activities.

b-1 Abatement and preventive fugitive dust control measures shall be approved by the Division and may include, but shall not be limited to:

- wetting down, including pre-watering;
- landscaping and replanting with native vegetation;
- covering, shielding or enclosing the area;
- paving, temporary or permanent;
- treating, the use of dust palliatives and chemical stabilization;
- detouring;
- restriction of the speed of vehicles on sites;
- prevention of the deposit of dirt and mud on improved streets and roads and other such effective means of dust control as the Division may deem necessary;
- disturbing less topsoil and reclaiming as soon as possible.

b-2 Sequential blasting shall be employed whenever or wherever feasible to reduce the amounts of unconfined particulate matter;

b-3 Such dust control strategies as revegetation, delay of surface compaction and sealing, shall be applied.

b-4 Haulage equipment shall be washed or wetted down, treated, or covered when necessary to minimize the amount of dust emitted in transit and in loading."

The mine development would constitute a new source of emissions of all the regulated air pollutants and would therefore be subject to analysis of significant deterioration of air quality (number 4) and air quality maintenance planning (number 5). At the present time, the significant deterioration regulations are under development by the state according to guidelines from EPA. The final regulations would place limitations on ambient air quality degradation in the area of the mine that may include limits more restrictive than the ambient air quality standards. The regulations will probably be written as specific emission limitations, based on expected impact on air quality. But since fugitive emissions are not easily measured, as exemplified by the Colorado fugitive dust regulation which does not refer to the quantity of dust, it is not clear what form the new regulations will take.

The purpose of air quality maintenance planning is to assure that ambient air quality standards once achieved are not exceeded at a later date due to new sources. Baseline air quality in the mine area is presently better than the standards. The air quality maintenance plan now being developed by the State and EPA will address the impact of the mine and any other new or expanding sources in the area. Significant deterioration regulations, if promulgated, will become part of the plan.

There are several other considerations besides ambient air pollution which mandate control of fugitive emissions. The most important concern is employee health and safety. Worker conditions are regulated by the Mine Enforcement Safety Administration (MESA).

Water Resources, Soils, and Terrestrial Flora

Recently acquired preference right lease C-0128433 contains 14 sections of environmental stipulations concerning pollution, rehabilitation,

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fish and wildlife, health and safety, etc. These stipulations will govern operations on Federal lease land at the company's Energy 2 mine. A copy of Federal coal lease C-0128433 with the environmental stipulations is exhibited in Appendix D.

The Colorado State Reclamation Board has set forth the following reclamation standards for the last two permits issued to Energy Fuels Corporation. These permits cover operations at Energy 1 and 3.

a) The operator shall maintain internal combustion engines and monitor and control fugitive dust, during all phases of the operation, to keep same in compliance with the air pollution and dust emission standards set by the Colorado Air Pollution Control Commission.

b) The operator shall comply with all local governmental zoning and land use requirements.

c) The operator shall fence the area covered by the permit until such time as reclamation is complete and bond is released in full. If in a rural setting the fence shall be of suitable construction so as to prevent entry onto the subject property by livestock. If in an urban setting the fence shall be a chain link fence six feet in height topped by three strands of barbed wire canted outwards.

d) The operator shall remove, as a separate layer, all topsoil from the area of the mine as required by mine operations and progress. Whenever possible the operator shall, immediately after such topsoil has been stripped from an area to be mined, distribute such topsoil as a permanent layer over an area which has been backfilled. If the topsoil is not utilized immediately, segregate it in a separate pile from other spoil and when the topsoil is not replaced on a backfill area within a time short enough to avoid deterioration of the topsoil, maintain a successful cover by quick growing plants or other means thereafter so that the topsoil is preserved from wind and water erosion, remains free of any contamination by other acid or toxic material, and is in a usable condition for sustaining vegetation when restored during reclamation, except if topsoil is of insufficient quantity or of poor quality for sustaining vegetation, or if other strata can be shown to be more suitable for vegetation requirements, then the operator shall remove, segregate, and preserve in a like manner such other strata which is best able to support vegetation.

e) All stockpile and storage areas shall be indicated in the mining plan. Stockpile and storage areas shall be located in such an area that wind and water erosion will not contaminate or pollute topsoil stockpiles or aquatic systems or areas being reclaimed or having been reclaimed or adjacent undisturbed areas.

f) The operator shall begin backfilling within thirty (30) days of completion of mining in any specified area or when the linear distance between the area presently being mined and the area where mining operations have been completed reaches 1,000 feet.

g) Backfilling shall be accomplished by first replacing overburden exclusive of topsoil in an area in which mining has been completed and by compacting to prevent subsidence. Backfilling will be completed by replacing the topsoil over such other overburden and to a depth of not less than eight (8) inches nor more than eighteen (18) inches.

h) The topsoil, after replacement, shall be smoothed and prepared for seeding by compacting followed by a roughening to a depth of not less than one inch nor more than four inches.

i) The operator shall insure that all debris, acid, or highly mineralized toxic materials, or materials constituting a fire hazard are treated or disposed of in a manner designed to prevent contamination of ground or surface waters and sustained combustion.

j) The operator shall establish on the regraded areas, and all other lands affected, a diverse, effective and permanent vegetative cover native to the area of land to be affected, or introduced species, capable of self-regeneration and plant succession, where appropriate. The extent and type of seed cover shall be sufficient to achieve the postmining land use plan approved by the Board. The Board shall, after considering the choice of the operator, as well as information obtained from agricultural experiment stations, experienced reclamation personnel of the operator, and other research or successful experience with seeding and planting, determine the type and mixture of species to be utilized in the plant cover, as well as the rate, method, and time of seeding or planting.

k) The operator shall within thirty (30) days after planting or seeding an area, report in writing to the Board the species planted, the mixture and density of seeds or plants, the time and date of planting, planting methods utilized and the area planted by the operator in revegetation attempts.

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l) No domestic use shall be permitted on any revegetated land until such time that the Board approves an initial, controlled and experimental period of domestic use to test the capability of the vegetation to withstand a measured and monitored level of the impact of such use.

m) The operator shall control erosion on or along haul roads by the use of drainage ditches, culverts and check dams. Natural drainways or drainways constructed to alleviate flood conditions in the area shall be kept free from overburden, stockpiles and topsoil.

n) Ridges and peaks shall be graded so as to create finished slopes at a maximum angle consistent with the surrounding terrain, the nature of the materials composing the slope, the needs of the revegetation plan and the safety considerations of the intended use.

o) Consistent with C.R.S. 34-32-111, land stabilization and reclamation shall be completed within three (3) years after the date the operator advises the Board that reclamation has commenced. The operator shall advise the Board on July 1 of each year as to any reclamation undertaken in the preceding 12 months. Such notification shall be in the form of a map as required by C.R.S. 1973, 34-32-111(a). If the property is sold, leased or transferred in any manner, the new owner, lessee, or person having control must file a request to succeed operator (LRB Form 7) with the Colorado Land Reclamation Board or with the Commissioner of Mines, and shall agree to be bound to the unexpired period of the three year term.

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p) In the event the mine area is subjected to severe drought that prevents establishment of vegetation and for which there is meteorological and/or agrophenological evidence that supports the contention of drought limitation to reclamation success, the three (3) year term for completion of the reclamation shall be extended one year for each growing season during which drought conditions exist that prevent the establishment of vegetation.

q) Erosional damage to the reclaimed areas shall be controlled as soon as is practicable by refilling, compacting and reseeding of the eroded areas as well as reseeding any vegetation disturbed during the erosion control process.

r) All refuse shall be disposed of in a manner that will control stream pollution, unsightliness, or deleterious effects from such refuse, and water from the mining operation shall be diverted in a manner designed to control siltation, erosion, or other damage to streams and natural watercourses. If the operator plans to discharge into a waterway, then a permit to discharge into same shall be obtained from the Division of Administration, Colorado Department of Health.

s) If the Board determines that the requirements of reclamation have been met in their entirety, the bond shall be released.

t) The operator shall meet such other criteria as are necessary to achieve reclamation in accordance with the purposes of this act, taking into consideration the physical, climatological, and other characteristics of the site, and to insure the maximum practicable recovery of the mineral resources.

u) Through periodic inspection by the Land Reclamation Board on their representatives the progress of the reclamation project shall be monitored. If the operator is found to be in non-compliance with any portion of this permit or any part of the Colorado Open Mining Land Reclamation Act, C.R.S. 1973, 34-32-101 et seq., the Board shall notify the operator of such violation and shall attempt, by private conference, conciliation, and persuasion, to remedy such violation. The operator shall be allowed thirty (30) days from the date of notification to remedy the violation. If the operator has not remedied the violation in the thirty (30) day period, the Board shall require the operator to appear at a hearing before the earliest meeting of the Board no less than thirty days after the date of the notification of the hearing. After the hearing the Board shall enter such order as it deems appropriate to effectuate the purposes of the Colorado Open Mining Land Reclamation Act and shall forthwith mail a copy thereof to said operator and the operator's attorney of record, if any. If such order of the Board is not complied with in the required time, the Board may request the office of the Attorney General to commence proceedings under Section 34-32-113, C.R.S. 1973.

Measures provided by Regulation No. 1, Section 9, Emission Control Regulations for Particulates and Sulphur Oxides for the State of Colorado that control fugitive dust such as road watering, would reduce the impact of fugitive dust on plants and soils.

The Endangered Species Act of 1973 provides for the conservation to the extent possible of plant species facing extinction. If species in

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this category were found on the Energy Fuels mine sites their protection would be provided for by enforcement of this act.

Terrestrial Fauna

The Endangered Species Act of 1973 makes it unlawful to harass an endangered species in any way. The possibility of peregrine falcons using the area has been addressed. Therefore, to insure that no action is taken that would interfere with this species' activities, a study would be conducted prior to any work being done. This study would identify all endangered species' habitat and use areas, or prove that endangered species do not use the subject area.

In compliance with CFR 30, 211:16, all core holes would be filled with a mud or cement substance to mitigate losses or damage to any faunal species.

Archeological Resources

Legislative backing for protection of archeological resources comes from a variety of legislation. The Regional Analysis contains a detailed account of these regulations which are only summarized in this section.

The 1906 Federal Antiquities Act makes it illegal to damage, destroy, appropriate, or excavate any historic or prehistoric object, and it requires the issuance of antiquities permits to qualified professionals for purposes of conducting surveys, testing, and excavation.

Authorization for the Secretary of the Interior to maintain the National Register of Historic Places is given by the 1966 Historic

Preservation Act; the Advisory Council on Historic Preservation is also established by the Act. All Federal actions affecting existing or proposed National Register Properties must be reviewed by the Advisory Council (according to Section 106 of the Act).

The National Environmental Policy Act of 1969 also identifies the Federal government's continuing responsibility to preserve important historic and cultural aspects of our national heritage.

Establishment of the Federal government in a leadership role of preserving, restoring, and maintaining cultural resources was accomplished by Executive Order 11593, 1970.

Protection of cultural resources on the State level is given by the Colorado Antiquities Act of 1973 which is essentially a parallel form of the Federal Antiquities Act. The Colorado Land Use Act of 1974 further authorizes local governments to designate cultural resources as areas of state interest with commensurate protection.

Most recent Federal legislation is the Archeological and Historical Data Conservation Act of 1974 which requires protection of cultural resources affected by any Federal or federally licensed construction project.

Two relatively recent solicitors' opinions further clarify the law's intent. An opinion issued in September, 1974, declares with respect to privately-owned surface acreage underlain by Federal mineral and coal lands, that the Section 106 Advisory Council review provisions are applicable. In addition it states that BLM has a NEPA responsibility to identify and consider the effects of its programs on cultural resources of these lands. Lastly the final responsibility for inventory and nomination to the National

Register of cultural resources on these lands rests with the agency responsible for approving the potentially impacting action, which is the BLM.

A second solicitor's opinion of April, 1974, indicates that professional cultural resource surveys must be required as a part of the applicant's mine plan.

In order to identify all cultural resource values adequately to satisfy Section 106 requirements of the 1966 National Historic Preservation Act, an intensive archeological survey must be completed. Dr. Olson's cultural resource study was completed as a reconnaissance survey, which is only partial fulfillment of the law.

For all practical purposes, not all cultural values having surface evidence will be identified in the required survey. In addition other sites may be buried by alluvium and hidden from view. The regulations themselves would also do little to prevent theft and vandalism of cultural resources due to increased visitor use pressure.

Historical Resources

All current antiquities legislation enumerated in the Archeological Resources section is also applicable to protection of the area's historical resources.

Aesthetics

Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulphur Oxides for the State of Colorado, Section II-D, Fugitive Dust, (Colorado, 1971) prohibits mining operations from occurring without a permit that specifies fugitive dust control measures. These measures will be implemented to reduce atmospheric haze that results from airborne pollutants and particulates.

The Colorado Department of Health's water quality standards (1974) provide regulations consistent with the provisions of the Federal Water Pollution Control Act amendments of 1972. The waters of Trout, Fish, Middle, and Foidel Creeks are thereby required to be free from the aesthetically damaging effects of floating debris, scum, and discoloration.

Colorado's Open Mining Land Reclamation Act of 1973 directs the mine operator to assume several duties in Section 92-13-6 of the act. Part 1 dictates that spoil pile peaks and ridges be graded to a width of not less than 15 feet, and that a gently undulating skyline be maintained. This regulation will help mitigate the strong line and form-dominant minus deviations of surface mine spoils, and will legally ensure that Energy mine spoils will be at least partially graded.

Part 1-f of the same section in the above act also directs refuse disposal in a manner that will control stream pollution and unsightliness. The Energy mines are hereby constrained to maintain a litter-free environment by providing for an unobtrusive sanitary landfill and by maintaining an overall litter-free landscape.

Part 1-a, Section 92-13-6, of Colorado's Open Mining Land Reclamation Act provides for consultation between the State Land Reclamation Board, the county commissioner, and the local board of supervisors of the soil conservation district. This required consultation process will provide opportunities for the reclamation board to learn of aesthetically sensitive areas at the Energy mines, and to take appropriate action to mitigate impacts to visual resources.

Impacts to mood-atmosphere values that will be caused by increased noise levels will be partially mitigated by implementing the provisions of Colorado Senate Bill 197 (1971), which establishes maximum permissible noise levels and abatement procedures. Federal noise pollution guidelines are outlined in P.L. 91-604, The Clean Air Act, Section 401 -- Noise Pollution and Abatement Act of 1970. The Office of Noise Abatement and Control, established by this Act, provides for enforcement of the guidelines contained in the Act. Enforcement of these laws will achieve the lowering of noise levels adjacent to the Energy Mines.

The above legislative acts will be effective only to the extent that they are enforceable, that the standards set forth are enforced, and that these minimum standards are indeed effective in reducing impact. The probability of all of these actually being enforced, on the ground, is something less than 100 percent, as evidenced by impacts presently occurring from similar ongoing operations in the region. For example, note the visual intrusions that have resulted from mining operations at Energy 1 (Figures EII-25, 28, and 32), Energy 2 (Figure EII-5), and Energy 3 (Figure EII-11).

Recreation

Water quality standards established by the Colorado Department of Health (1974) also provide regulations that will be used to mitigate impacts to recreation resources. All State waters should be free of substances or conditions that are toxic to plant, animal, or aquatic life, that produce undesirable aquatic life, and that import any undesirable taste to fish flesh or make fish inedible. These regulations prohibit mine-caused damage to the recreational potential of downstream fisheries in Fish, Middle, Foidel and Trout Creeks, and in the Yampa River.

The Colorado Open Mining Land Reclamation Act of 1973 contains several provisions for mitigating recreation impacts. Section 92-13-6 describes the duties of mine operators. Part 1-f directs the disposal of refuse in a manner that will control stream pollution, siltation and other damage to streams and water courses. This regulation also prohibits actions which would indirectly impact downstream recreational fisheries potential.

Part 1-g of the same act directs the operator to determine the reclaimed use of the mine, and it provides for this determination in consultation with the local board of county commissioners, as well as with the board of supervisors of the soil conservation district. This would provide input from other land-use decision makers who would determine and direct reclamation efforts to respond to the growing demand for recreational facilities.

The recreational value of archeological and historical resources will be protected by enforcement of the provisions of current Federal and State antiquities legislation. These include The Federal Antiquities Act (S.4698, June 8, 1906) which makes it illegal to appropriate, excavate, injure, or destroy any object of antiquity; this act also requires issuance of permits to qualified applicants for survey or excavation on Federal lands. The National Historic Preservation Act (P.L.89-665, October 15, 1966) established the National Register of Historic Places; it also requires a review of all Federal actions affecting existing National Register entries by the President's Advisory Council on Historic Preservation. Executive Order 11593 (May 13, 1971) expanded P.L.89-665 to provide a review of any Federal

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action affecting properties eligible for inclusion in the National Register of Historic Places. Section 101(b)(4) of the National Environmental Policy Act of 1969 (P.L.91-190, January 1, 1970) directs the preservation of "important historic, cultural and natural aspects of our national heritage..." The Archaeological and Historical Data Conservation Act of 1974 (P.L. 93-291, May 24, 1974) provides for the preservation of antiquities "which might otherwise be irreparably lost or destroyed as a result of any alteration of terrain caused as a result of any Federal construction project or Federally licensed project, activity or program."

The Colorado Antiquities Act (H.B. 1569) reserves all antiquities on State owned lands to the State of Colorado and prohibits the destruction, appropriation, injury, or excavation thereof; permits are also required for qualified applicants to conduct surveys.

The degree to which these legislative enactments will be successful in mitigating impacts will be dependent upon their enforceability and actual on-the-ground enforcement. Based upon past observations of similar coal mining operations, enforcement of current laws has not been completely effective in mitigating applicable impacts. For example see Figure EII-5 at Energy 2.

Measures to be Included if Authorization is Granted

Geologic and Geographic Setting

Topography

Energy Fuels has stated its objective of returning the land to as near its natural configuration as possible. No specific mention was made of the small intermittent streams that originally drained the area. Proper drainage of reclaimed areas would be attained by careful planning of the reshaping of the topography.

Stratigraphy

Loss of a small part of the stratigraphic section would be mitigated by recording of data from drill holes made by the company.

Structure

Most structures in the strata which would be obliterated by mining are minor. An exception would be the graben and faults in Section 8, T.4N., R.86W. If mined, this area would be carefully studied, and if scientifically warranted, geologic report would be published to compensate for the record lost by mining and reclamation activities.

Geomorphology

Landforms would be constructed in the reclamation phase so they are not discordant with the surrounding natural landforms. Bulging hills constructed near the main streams would be avoided, as in Energy 2 mine near Fish Creek. Courses of meandering streams (Fish and Foidel Creeks) would not be straightened, to avoid increased stream velocities, erosion, deposition, and loss in water quality.

Where mining takes place on the gentle slope of a cuesta, as in Energy 1 and 3 mines, spoil would not be placed or piled high on the crest of the ridge. This would prevent the spoils from being carried down the steep slope as landslide, mudflow, creep, or slump materials.

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Mineral Resources - Coal

Under the present mining methods, the amount of coal lost in mining would be minimized by careful recovery of coal from any lenticular or thin coal beds overlying the mined bed. Drilling would be on closely spaced centers to assure that no other bed below the lowest mined bed is within stripping distance.

Water Resources

Stabilizing all spoil piles with devices such as water bars would minimize erosion and stream sedimentation during and following mining activities. Degradation of surface water quality would be mitigated by location of tipples and haul roads in a manner that would minimize accumulation of coal dust in the streams.

In some places wells or springs would be destroyed or dried up because of mining operations; these water sources would be replaced with wells extending into undisturbed sandstone beds below mine spoils.

The sum of all of the various mitigating measures would reduce the sediment yield from the reclaimed mine spoils by about 90 percent, for a total annual reduction of 1,940 tons compared to spoils with no mitigating measures applied.

Air Quality

Control of the largest source of pollutant, fugitive dust, would be part of mine operations. Fugitive dust from mining operations might be a safety hazard due to impairment of worker visibility, and increase in the risk of accidents, or interference with safety equipment. Another consideration of dust control would be the efficiency of overburden and coal handling which is improved if the quantity of fines and the amount of airborne dust is limited.

A wide variety of control measures are possible to help prevent the generation of fugitive dust (see the list in the last section). The most common method for dust control on surfaces is the application of water to agglommerate fine particles, and thus prevent them from becoming suspended in the atmosphere. Watering is only as efficient as the success in keeping the disturbed material (either by wind or mechanical action) wet. In the dry Colorado climate, this can be very difficult. Over-watering must be avoided because of the obvious safety hazards of mud on non-level surfaces. On haul roads that are semi-permanent, an additive such as a petroleum-based material would be used to form a crust that approximates the effect of paving. Water would also be applied on surfaces other than roads to dampen material about to be moved.

Fugitive dust from process operations would be controlled by watering at transfer points, such as conveyor ends or loading stations. The placement of hoods connected to a ventilation and dust collection system over sources such as crushers and sorters, would limit emissions from mechanical treatment of coal. General cleanliness and the prevention of spills would reduce the amount of fugitive dust.

Particulate matter would be forced into the atmosphere in the blasting operations, but the amount that remains airborne would be controlled sufficiently if care is taken in the blast design. The function of blasting, the break-up of material so that it can be moved, would be accomplished without the production of a large fraction of very small particles, by proper sequencing and control of amounts of explosive.

Coal fires as a source of pollutants would be minimized by careful design of overburden piles and preventive action. Once a fire starts, only prompt, thorough fire fighting can prevent a major air pollution problem.

All of the gaseous pollutant emissions from the mine result from vehicle exhausts and fires. The required use of automobiles, trucks, and other heavy equipment complying with EPA vehicle emission regulations would be expected to be the only available control measure.

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Soils

Mechanized equipment such as scrapers would be used for both stockpiling and replacement of topsoil to minimize soil mixing with other less desirable geologic material. Productive soil would not be buried or mixed with unproductive overburden or toxic material. Loss of fertility in topsoil would be minimized by immediate replacement. Toxic or other undesirable material, such as moderate to high sodium layers, would be buried 60 inches or more below the surface.

Water bars, contour furrows, and other surface manipulations to restrict runoff would be utilized to minimize erosion of the reclaimed surface. Prior to topsoil replacement the area would be ripped, if shaping by heavy equipment has resulted in compaction of the spoil. After topsoil replacement, seedbed preparation (tillage) would be accomplished before planting, and off-road vehicle use restricted to prevent topsoil compaction.

The lessee would provide the BLM detailed soil and overburden (geologic strata between soil and strippable coal seams) information on the area to be mined as follows: (This is to supplement the information now available and to insure that mitigating measures can be accomplished).

1. Detailed soil map of the lease area to standards designated by the BLM (family level of classification - Soil Conservation Service) to determine location, extent, and thickness of topsoil;
2. Soil and overburden samples taken down to the coal seam for chemical and physical data to determine the presence or absence

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of toxic material that affect plant and animal life, and record depth and thickness of that layer according to standards designated by the BLM;

a) Sample each morphological soil horizon for chemical and physical data and record depth from surface at which the sample was taken;

b) Determine the suitability of present soils for reclamation supported by chemical and physical data according to standards designated by the BLM;

c) Determine overburden suitability for reclamation (supported by chemical data) when sufficient topsoil is not present, according to standards designed by the BLM;

3. Determine present soil moisture relationships before mining:

a) Determine climatic conditions on the lease area (precipitation, temperature, potential evapotranspiration);

b) Determine the amount of available soil moisture during the growing season;

4. After topsoil has been placed following mining and before planting determine nutrient level (NPK) of topsoil, and underlying spoil (generally first one-foot raw spoil).

Flora

To best mitigate the loss of existing vegetation, a detailed reclamation plan would be developed before the mining operation begins, in conjunction with the mine plan. Baseline climatic, soils, vegetation, wildlife, and current land use information would be collected and utilized to determine the best land use or uses after mining, and the best ways of achieving them.

After mining proceeds every effort would be made to remove topsoil from areas to be mined and replace it directly on reshaped spoils. Immediate replacement of topsoil is most desirable where grazing land is proposed, because some native plant species and microorganisms will be transplanted live, thus speeding reclamation of the mined area. If topsoil is replaced at a time other than optimum seeding dates, spring or fall, it would be seeded with a quick-growing annual to guard against erosion and compete against invading weed species. If topsoil cannot be replaced immediately and is stockpiled for more than a few months, it would also be seeded with a quick-growing annual to control erosion; if it is to be left for periods longer than a year, it would be seeded to a mixture of perennial grasses and/or legumes. Topsoil stockpiles would be placed on areas to be mined or areas already mined if possible, so additional vegetation is not destroyed. Topsoil would be replaced to the maximum depth possible, with a minimum of approximately 8 and 18 inches on areas to be returned to grazing land and cropland respectively, to insure vegetative establishment and production. In areas where topsoil is found in large quantities it would be entirely removed and stockpiled so it can be replaced on areas where topsoil is lacking.

If possible during the overburden removal process the fragmented material below the topsoil would be placed on top of the spoil piles. This material has proven useable as a plant growth material in the area, and would thus provide a useable growth media for deep rooting plants, and speed the soil building process because of its fragmentation.

Spoil shaping would begin as soon as possible to reduce the length of vegetative loss. Spoils would be shaped in accordance with the planned land use: cropland areas reshaped as flat as possible, and grazing lands returned to the approximate original contour. Areas to be returned to wildlife habitat would be shaped to create various micro-climatic conditions that are characteristic of the existing differences in soils and exposure, thus producing diversity similar to the existing ecosystem.

After spoils have been shaped the area would be ripped or deep chiseled, if shaping by heavy equipment has resulted in compaction that would inhibit moisture or root penetration. This is especially important where overburden removal and replacement is accomplished entirely by scrapers. On areas returned to wildlife habitat seed mixtures would be varied according to microclimatic conditions produced by the shaping process.

Energy Fuels plans to transplant native trees and shrubs from unmined to reshaped areas where the land use objective is wildlife habitat. This program would be utilized to the maximum to mitigate the loss of existing shrub and tree vegetation. Trees and shrubs, especially aspens, would be transplanted to areas of most favorable soil moisture conditions produced by shaping and topsoil replacement operations. Energy Fuel's current seed mixture is composed of four introduced plant species. To produce a diverse self-sustaining vegetation on lands planned for grazing, this mixture would be expanded to include more species, as many as possible native to the area. When climatic conditions are such that seedings fail, reseeding should be implemented until vegetation is established. If localized adverse soil conditions are such that vegetation will not establish, the area would be covered with at least 18 inches of suitable material and revegetated.

In areas of extremely adverse soil moisture conditions or very steep slopes, a mulching practice, such as straw or hydromulch, would be utilized to increase revegetation potential. Where slopes are greater than 33 percent, a surface manipulation practice would be implemented to impede runoff and induce infiltration; this will increase success of revegetation attempts.

After replacement, topsoil fertility levels would be determined, and fertilizer applied with rates and composition dependent on requirements of plant species being seeded. If fertility levels are too low for seedling establishment, fertilizer would be applied shortly after seedling emergence, unless the area is seeded in the fall, in which case it should be applied in early spring following seeding. If soil fertility levels are adequate for seedling establishment but not for sustained growth, fertilizer should be applied in early spring of the second growing season.

Berg (1975) found that the application of adequate nitrogen (N) for good initial ground cover on sandy uranium spoils in northwestern Colorado has a short-lived effect on very N-deficient spoil material, and that considerably more N would have to be applied before a self-maintaining system can be expected. This N can possibly be supplied after a few years by planting N-fixing species such as alfalfa, but would create impacts described in Chapter III of the Regional Analysis, such as bloat in cattle. Where soil fertility rates are very low and plant growth is deficient, a maintenance fertilizer program would be implemented until the soil system is self-maintaining.

Berg (1975) felt that the most important reason to replace topsoil is to supply N. He stated that an acre of soil one foot deep containing 0.1 percent N (a fair average for Colorado) has a N content of about 4,000 pounds, which in terms of current fertilizer prices would be worth approximately $1,000. The long-term cost of adequate fertilizer N, where not supplied by N-fixing plants, might well exceed the cost of topsoil replacement. An intensive management program that includes fencing would be implemented to allow successful revegetation following mining.

Terrestrial Fauna

To mitigate potential impacts to wildlife, all new fences would have to be constructed in conformance with accepted guidelines for fence construction in big game use areas.

Reseeded areas would be fenced to exclude livestock use. This, however, would not protect such areas from wildlife. To mitigate the impact on trees and shrubs additional protection would be needed until these plants become established.

To help mitigate impact of water quality reduction in Fish, Foidel and Middle Creeks it would be helpful to avoid any vegetal or soil disturbances within a minimum of 60 feet of the creek. No spoils would be piled within this area, and all water coming out of spoil piles or mining areas would be diverted into a settling pond to allow all pollutants to settle out before the water goes into the streams.

To mitigate the expected alteration of the existing ecosystem due to the proposed revegetation plan, it would be necessary to make every effort to return mined areas as closely as possible to original soil and vegetal conditions. Micro- and macro-environments would closely approximate existing conditions to reduce longlasting impacts on terrestrial fauna. (For more information on this approach see the mitigations proposed under terrestrial flora).

High rodent populations expected to utilize revegetated areas would reduce natural capabilities to quickly establish a self-sustaining floral cover. To mitigate this impact it would be necessary to attempt to control these rodents; traps would be used, and perching structures for rodent eating raptors could be provided in revegetated areas. A closely controlled and monitored poisoning program could be used in limited cases, if all other efforts failed.

Edge effect is very important to many wildlife species. Destruction of small patches of native vegetation within the general cropland areas would be partially mitigated by returning small patches of brush, native grass, and forbs to those areas revegetated for agricultural purposes.

Although Energy 1 spoils appear to be providing some degree of elk habitat, these areas would probably be improved by revegetating them to a greater mixture of plant species including brush, grass, and forbs. Future loss of elk habitat due to dumping spoils over the sides of canyons would be mitigated by prohibiting this practice.

Any new ponds created as a result of mining operations would be designed to maximize waterfowl use by creating irregular shorelines. If the ponds are of sufficient size, small islands would be added. Slopes and water depths would be planned to include deep and shallow waters, and variable slopes from 1:2-1:7. The ponds could be revegetated with immergent and submergent vegetation to provide both food and nesting, or escape cover for waterfowl and shorebirds.

Tree nesting birds such as some hawks, falcons, woodpeckers, and passerines would lose their nesting sites as a result of the mining operation; suitable trees or snags could be installed within reclamation areas to help mitigate these losses.

Existing roads would be used whenever possible to reduce vegetation disturbance. All disturbed areas, such as temporary roads and exploration drill pads, would be reclaimed as soon as possible to mitigate habitat losses. All off-road-vehicle use could be prohibited to reduce the impacts on vegetation and soil productivity that would result from this type of activity.

Topsoil removed from the initial cuts would have to be stockpiled. To mitigate the impact to the ecosystem, such areas would be located where a minimal degree of damage will be done.

All roadsides would be seeded, to hold soil and reduce sediment runoff, as soon as possible after completion of the road construction. Plant species of low palatability to big game animals would be used to reduce big game use along roadsides and mitigate potential vehicle-animal collisions.

Aquatic Biology

A buffer zone inside of which no surface disruption or spoil deposition would be permitted would be established on both sides of all streams which could be directly impacted by the proposed strip mining activities. This buffer zone would prevent direct alteration of natural stream channels and reduce increased sedimentation which would result from the proposed action. The extent of the buffer zone at each proposed mining site would be established by field surveys. Criteria which would be considered in determining the width of the buffer zone would be: (1) erodibility of alluvium at each location, (2) location of critical fish (e.g., spawning areas) and wildlife habitat areas, (3) nature of riparian and adjacent terrestrial vegetation, (4) local drainage patterns, and (5) existing physical and chemical quality of streams.

Measures which would decrease erosion and stream sedimentation and thereby mitigate impacts on the aquatic fauna in the proposed mining areas would be: (1) construction of basins for reduction of sediment in all water associated with the mining process before returning this water to local drainage, (2) construction of diversion ditches for returning water encountered or utilized in the mining process to local streams, (3) protection of all road cuts (including existing roads) by such means as rip-rap or buttresses, in order to minimize erosion from these areas, and (4) location of all areas to be utilized for the deposition of topsoil and overburden away from natural stream drainage areas in order to minimize erosion potential.

Archeological Resources

Archeological values derive their primary value from being preserved in-place; their secondary value occurs as an archeological dig. No archeological testing nor excavation stemming from intensive surveys on proposed action areas would be permitted unless the site is in imminent danger of being destroyed. This would preserve the site's primary value and subsequent educational interpretive values as well. It would also allow utilization of improved archeological survey and analysis techniques should the site be excavated at a future date, when more sophisticated techniques would be employed in the excavation. For all practical purposes, this guideline might not be followed for especially significant sites. However, to mitigate impacts to the open chipping site recommended for nomination to the National Register (see Table EII-3 and Figure EII-20), the site would be salvage excavated. This would be provided for only if there is no means available for modification of the proposed action to allow preserving the site in-place. This area is not included in Energy Fuel's current six year mine plan, but lies within competitive lease application C-22677, applied for by Energy Fuels. Impacts to subsurface archeological values can be partially mitigated by requiring an archeologist to accompany construction crews while working in recently deposited alluvium suspected of containing subsurface values. This is usually done at the recommendation of the surveying archeologist. Not all subsurface resources would be found in this manner, for there is no foolproof method for determination of subsurface archeological potential.

Historical Resources

The Foidel Canyon School is an important feature in local history, irrespective of its eligibility for nomination to the National Register, and therefore would not be destroyed. As with archeological resources, its primary value lies in being preserved in place.

Aesthetics

All stripping areas would retain irregular shaped perimeters to blend with the natural landscape. Only if an established rectangular agricultural pattern is present would the stripping area boundaries be straightened to borrow form from the agricultural pattern.

Where vegetative removal is necessary it would also conform to an irregular pattern to simulate natural openings as nearly as possible. Disturbance of vegetation would be kept to a minimum as breaks in the ground cover tend to dominate the view.

When trees or shrubs are removed, they would either be buried or returned to the site.

Spoil piles would be completely leveled to a gently rolling landscape that complements the adjacent topography; they would be leveled as soon after each pit is mined, as is feasible to do so safely.

No spoils would be dumped over ridges or escarpments onto adjacent undisturbed terrain. In fact all stripping operations would be restricted from ridgetops and escarpments to retain their characteristic form, line, and texture. This restriction would begin at a line where stripping operations become silhouetted, or where danger of overspill or slumping occurs.

All cut-and-fill slopes would be backsloped in a rounding grade that blends into the slope of the adjacent terrain. Successful revegetation of these slopes would occur with indigenous species that are present on immediately adjacent terrain.

Buildings and equipment structures built to a low profile would more easily borrow from the adjacent landscape's strong horizontal components. Careful attention to architectural design would avoid the creation of strong vertical lines in these structures.

Road and right-of-way alinements would borrow from the already existing lines in the characteristic landscape. Where agricultural patterns occur as at Energy 2, these linear features might best parallel edges of fields. In areas of natural terrain, integrity of natural landscape visual units can best be protected by placing alinements along natural transitions between hills and valleys, or at edges created by forest and woodland types. Straight roads and rights-of-way are generally foreign elements and would always be avoided, unless they can borrow from straight lines inherent in the characteristic landscape. Rights-of-way and roads would also be routed obliquely to viewshed sequences and to promontories.

Rights-of-way and access roads would not parallel public roadways, unless separated from them by effective vegetative or topographic buffers, or by adequate distance (i.e, middleground or background). Benefits of vegetative screening adjacent to facility developments would be utilized to help screen their incongruous lines. Earth mounding techniques would also be used to help screen minus deviations.

Electric transmission line alinements would also be located at a sufficient distance (out of foreground) from the road, and if possible, against a backdrop of trees or topography.

Vegetative removal along rights-of-way would be minimized and medium-sized trees and shrubbery would be retained within the rights-of-way. Any necessary clearing would selectively thin existing vegetation at its edges to reduce the tunnel effect. When transmission lines enter heavily wooded areas, vegetation removal would be avoided as much as possible. To prevent an unobstructed view down rights-of-way, their alinement would change after entering the corridor.

Reclamation efforts on coal stripping areas may concentrate on reestablishing plant communities whose colors are native to the site. Alternately they may center on the creation of an agricultural or pastoral landscape whose color, though different from the adjacent landscape, can provide an attractive visual focal point. Both are visually acceptable alternatives as long as their form and line elements complement those of the characteristic landscape (e.g. an undulating surface and irregular edges).

Coal facility developments (e.g. buildings and tipples) would be painted a non-reflective warm green to brown color to help blend their usual silver form with the characteristic landscape. Transmission conductors would be non-reflective, and the structures would also be painted or stained as discussed previously. Unless transmission lines will not be viewed against the sky, their color would be chosen on the basis of its ability to blend with both sky and immediate landscape.

All surface disturbing activities would be restricted from flood plains and active drainage courses to reduce siltation in adjacent streams; water diversions would not be allowed to run uncontrolled over alluvial or colluvial areas.

On coal haul roads and mine access roads regular sprinkling with water or oiling would be required to control road dust.

Energy Fuels would concentrate on maintaining a litter-free environment by having a regular cleanup program to properly dispose of waste, litter, and discarded equipment.

Wherever possible, incongruous elements of the proposed action can be moved from foreground landscapes to reduce their scale, visibility, and ultimate impact. By referencing lands not visible on the landscape visibility maps (Chapter II) alternate routes may be determined for rights-of-way, roads, and other elements that make them less visible or altogether invisible.

Other elements of the proposed action that are inherent minus deviations can also be relocated on areas that are viewed more obliquely; however transmission lines and other elements with significant vertical dimensions are best routed against a backdrop to help screen their strongly line-dominant form and to avoid silhouetting. (See landscape visibility maps for identification of mitigating areas.)

Lastly, analysis of the landscape visibility maps reveals visual landscape units that are less visible than others in terms of the number of times viewed and length each view lasts. These units, as well as those that occupy more than one distance zone, identify sensitive areas from which inherently incongruous elements would be moved to mitigate their adverse aesthetic impacts.

Recreation

All surface disturbing activities would be restricted from flood plains to reduce siltation caused by disturbance of alluvial material and subsequent damage to downstream fishing potential. Disturbance of steep slopes immediately adjacent to the flood plains would also be avoided for the same reason.

Increased safety for recreation visitors and sight-seers on county roads would be promoted by prohibiting the dumping of overburden over escarpments or steep ridges adjacent to them.

Impacts to the inherent recreational capabilities of cultural resources would be mitigated as outlined in Chapter IV, History and Archeology.

Earth mounding and shaping techniques may be employed to increase recreational opportunities on mined-over areas. Within the basic rolling vegetative type, waterways and ponds would be constructed to increase aesthetic attractiveness and wildlife viewing opportunities. Mounding and shaping would be used to create ecologic niches and cover for more animal species.

Chapter V

Adverse Impacts Which Cannot Be Avoided

THIS CHAPTER PRESENTS THE RESIDUAL ADVERSE IMPACTS OF ENERGY FUELS CORPORATION'S PROPOSED ACTION WHICH WOULD REMAIN AFTER APPLICATION OF THE MITIGATING MEASURES DISCUSSED IN THE PRECEDING CHAPTER. THE FOLLOWING DISCUSSION COMPLETES THE ANALYSIS EQUATION: IMPACTS MINUS MITIGATIONS EQUALS ADVERSE IMPACTS WHICH CANNOT BE AVOIDED.

CHAPTER V

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Geologic and Geographic Setting - Paleontology

Adverse environmental effects that cannot be avoided would include alteration of the surface from present natural contours and landforms to a mixture of these natural forms and man-made forms which would be obviously artificial. Natural landforms are in equilibrium with degradational processes, but an undetermined period of time would be required for man-made ones to reach this equilibrium. Different rates and modes of degradation by erosion, mudflows, landslides, slumps, etc. might be expected from reclaimed areas than from the remainder of the mined areas. Replacement of natural intermittent streams with man-made drainage controls would be unavoidable in strip mining.

Impacts to all fossils would be difficult to mitigate; some would most certainly be destroyed. Generally speaking, these losses would not be significant.

Mineral Resources

Use of very large equipment in the proposed mining plan for rapid removal of overburden and of coal, would cause an unavoidable coal loss of about ten percent. For the Energy 1 and 3 areas this loss would amount to about 1,800 tons/acre, and in Energy 2 mine area about 720 tons/acre.

Water Resources

Ground Water

Ground water is recharged on slopes and moves down these slopes to be discharged through springs and into streams. Strip mining disrupts this natural system, destroying springs and reducing flow to the streams. Water supplied by the springs could be replaced by wells, but reduction of the normal ground water in flow into the streams cannot be avoided; the amount of this reduction is small and not likely to have any serious consequences.

Surface Water

Natural drainage patterns and flow characteristics of Trout Creek watershed would be unavoidably altered because of the proximity of some of its major tributaries to the proposed mining areas (e.g., Fish Creek, Foidel Creek). Encroachments of spoil, construction materials, and mining equipment into natural stream channels might occur despite implementation of mitigating measures. In addition many minor intermittent water courses would be destroyed.

Proposed mining activity would produce unavoidable increases in sedimentation in the Trout Creek watershed, particularly in Fish, Foidel, and Middle Creeks. These local (i.e., confined to the analysis area) sedimentation increases could be highly significant or negligible, depending on the nature of the mitigating measures adopted by Energy Fuels.

Anticipated increases in total dissolved solids (TDS) resulting from the disposal of ground water from the mining process into the local streams should be negligible, if appropriate mitigating measures are implemented.

Sediment yield from the mine operation would be about 650 tons/year. This contribution would be in addition to an existing high sediment yield resulting from unprotected agricultural lands in the immediate vicinity.

Air Quality

The air quality during mining operations would be degraded in terms of all the presently regulated pollutants; suspended particulates, carbon monoxide, oxidants, sulfur dioxide, nitrogen oxides, and hydrocarbons. Mining could not be performed without air pollutant emissions from vehicles and the generation of fugitive dust.

Visibility in the vicinity of the mine would be decreased because of mine air pollutant emissions. Estimates indicate that total suspended particulate regulations would be exceeded near the mine. No other degradation in excess of standards would be expected.

Soils

If mining proceeds at the Energy Fuels mines, disturbance of soil cannot be avoided, Table EV-1. Soil disturbance would lower natural soil productivity of the area to some degree by compaction, mixing natural soils and causing accelerated erosion and sedimentation.

On the area to be mined, partial alteration of all soil horizons, parent material, and soil characteristics which have developed over long periods of geologic time could not be avoided. Present soil biota and soil forming processes would be destroyed. As an end result after mining, new soils would be formed with characteristics totally unlike those existing prior to mining.

TABLE EV-1

Acres of Soil Disturbance Associated with the Energy Fuels Mining Operations

Mine/Period	1976-1980	1981-1985	1986-1990
	Acres	Acres	Acres
Energy 1, 2, 3	1,840	1,665*	1,665*

*Estimated Dames and Moore.

Terrestrial Flora

Existing vegetation would be destroyed on the mined areas, roads, and areas needed for the population increase associated with the three Energy Fuels mining operations. The total removal of approximately 5300 acres will be unavoidable if this operation continues until 1990. Vegetation would be permanently destroyed on approximately 350 acres due to the construction of permanent facilities and the population increase.

The existing stage of plant succession would be unavoidably lost when vegetation is removed. Return to existing conditions would depend upon land use goal, and speed and success of reclamation effects. In areas where native lands would be reclaimed to cropland the loss of native vegetation would be an unavoidable impact. Also Energy Fuels' seeding mixture does not include any native species; unless the mixture is expanded, return to native vegetation would depend entirely on natural succession, and would be very slow at best. The soil and microclimatic conditions produced after mining might be very different from existing conditions, thus making it impossible to establish and sustain native vegetation. There is very little invasion of native species on spoils where topsoil has not been replaced and shaping has not been done (Chapter III Regional Analysis); if replacment of topsoil does not encourage invasion, the loss of native vegetation would be an unavoidable impact. Even on areas successfully revegetated, a 10 percent loss in productivity has been projected.

Terrestrial Fauna

Wild Fauna

The impact of the actual mining operation, removal of vegetation, and overburden and extraction of the coal, would be an unavoidable impact under the existing mine plan.

A permanent loss of the existing ecosystem would result from the proposed mining operation. Habitat components and the faunal species composition ratios would not be expected to return to their present status. The impact to small mammals, reptiles, amphibians, young birds, and invertebrates that are not mobile enough to escape from the mining progression could not be mitigated without trapping and transporting animals out of the mine area. Displacement of the more mobile species of wildlife, such as deer, elk, coyote, fox, and fledged birds from the mining area could not be mitigated. The increase in the probability of the spread of disease and parasites due to this increase in animal densities in adjacent areas would also be an unavoidable impact; interspecific and intraspecific intolerances would become evident in some species, especially during the breeding seasons, as population densities increase.

The one-year time lag from the removal of topsoil to the beginning of reclamation work would be an unavoidable impact, because reshaping could not be done in close proximity to the ongoing mine operations for safety reasons.

The ongoing highwall would create an unavoidable impact on normal animal movements. It would be impossible to backslope portions of this highwall and still maintain the same type of mining operation that has been proposed.

Increased human activity and noise level associated with the mining effort would impact bear, cougar, raptors, elk, and other animal use to some degree, especially close to ongoing work areas.

Probability of vehicle-animal collisions would increase with an increase in human activity. This impact could not be avoided without construction of fencing and wildlife passes (over or under the existing roads); road use and animal numbers would not be sufficient to justify the cost at this time.

As previously stated, the loss of vegetal cover and food would result from the mining operation; therefore the temporary loss of these habitat values to all wildlife species cannot be mitigated.

Expected increase in rodent populations during the revegetation program would almost certainly result in a corresponding but time-lagged increase in the numbers of coyotes, fox, snakes, and raptors. Although predator control would be possible, at least to a limited degree, the increase in predator numbers was included in this section because they should be allowed and encouraged to use the area; the predators would act to help limit the rodent numbers, and this in turn would aid in the establishment of the revegetated area sooner. Therefore no action should be taken to mitigate the increase in predator numbers.

Noise produced by mining equipment and the work itself would be expected to be great enough to preclude the use of the raptors' keen hearing, thereby reducing their hunting ability in close proximity to the ongoing mining operations.

Domestic Fauna

Removal of all livestock from the vicinity of the ongoing mining operation would be necessary to avoid accidental loss due to equipment-animal collisions or animals falling off the highwall.

Fencing of the revegetated areas to exclude livestock grazing for a period of two growing seasons would be needed to allow new vegetation to become established. This would mean a short-term loss of food for long-term establishment of a self-sustaining floral community.

Aquatic Biology

Aquatic ecosystems of the streams in the analysis area would be unavoidably impacted by sedimentation increases which would result from the proposed mining activity. An increase in the sediment load carried by a stream is accompanied by other adverse impacts on water quality (e.g., increase in temperature and decrease in dissolved oxygen content). Thus aquatic organisms, particularly benthos and periphyton, would be adversely impacted in those segments of Fish, Middle, and Foidel Creek which border on proposed mining areas. There would be inevitable displacement of the more mobile members of the aquatic community (e.g., fish) while many benthic organisms would perish. Displacement of organisms could result in an overpopulation of the aquatic habitat in streams above and below proposed mining sites.

There would be some unavoidable destruction of aquatic habitat resulting from proposed mining and related activities. For example, haul and access road construction across streams would remove aquatic habitat from production at each crossing site. Also encroachments of mining materials and activities into perennial streams would temporarily and/or permanently destroy aquatic habitat.

Archeological Resources

If presently unknown archeological sites occur on the mine property they would be subject to damage by direct surface disturbance, and could also be subject to vandalism and pothunting. Destruction of unknown subsurface resources would also be unavoidable; the significance of this impact would depend upon the nature of the unknown resource. Other impacts would also result from required as well as unnecessary excavation of significant archeological sites. Probably impacts identified in Table EIII-6 would, for all practical purposes, be unmitigatable, pending exact location of the area to be mined. Should competitive lease application C-22677 be granted to Energy Fuels and subsequently be mined, the National Register qualities of site number 4 (Table EII-13 and Figure EII-20) would be damaged unless the area could be mined without any surface disturbance of the site. Given the current mine plan, impacts upon this resource can presently be analyzed in no more detail.

Historical Resources

Impacts upon the Foidel Canyon School might occur from theft and vandalism due to greater numbers of people in the area. However, incidence of such an impact would be relatively infrequent.

Aesthetics

Given the foregoing mitigating measures, the net residual of adverse impacts should be significantly reduced. However there would be an increasing alteration of the characteristic landscape accompanying the proposed action. For all practical purposes, several visually incongruous elements or minus deviations would remain unmitigated.

The visually unconforming effect of roads and rights-of-way constructed on too steep terrain would be impossible to mitigate. Earth-moving equipment simply cannot negotiate slopes that are too steep, and therefore attendant cut-and-fill slopes would remain unmitigated. Examples may include the large road fills where excess material was dumped adjacent to the county road reroute at Energy 1.

Buildings and tipples can never totally blend with the adjacent terrain; painting with special colors is no panacea for camouflaging all structures, nor are any structural designs that enable them to fit into the characteristic landscape. The need for infield technical supervision to implement some of the principles of landscape architecture might realistically prevent their complete adoption.

Specific combinations of available topography and vegetation do not always allow implementation of a mitigating measure to the extent possible under ideal conditions; the result is only partial mitigation. In fact barring the option of completely screening elements of the proposed action that occur as minus deviations, their visibility can only be reduced by constructing them so they can borrow visual dominance elements from the characteristic landscape (and become plus deviations). Site specific considerations can only determine whether the net residual would still be adverse.

All dust and noise levels could be totally mitigated. The size of the area, adverse winds, the nature of overburden blasting, and coal loading procedures all could make total dust control unfeasible.

Economic considerations may make ridgetops or alluvial bottom mining highly desirable, and the controlling agency might for all practical purposes fail to see the need for exercising these aesthetic controls. Economic considerations might generally preclude imposition of government controls over private industry for aesthetic considerations that return unknown or questionable economic gains. Therefore proposed coal stripping operations at Energy Fuels night not be required to adopt all aesthetic mitigations. Internal economic considerations at Energy Fuels might also preclude their desire to employ these mitigating measures, as Energy's major objective is coal production.

The relative values of these unavoidable adverse impacts would depend on the visual exposure of the landscape visual units in which they occur. The most severe impacts would be those that can be viewed most directly, for the longest travel time, from the greatest number of points, and at the closest distance.

No major U.S. or State highway provides visual access to these areas. Local residents may logically constitute the greatest number of users on these county roads. Frontier Airlines flies regular scheduled daily flights over the Energy area at moderately low altitudes between Denver and

Hayden. The scale of Energy's coal operations compared to adjacent landscapes is relatively small; therefore the degree to which unavoidable adverse impacts affect viewers would be proportionately small.

Recreation

If surface mining occurs on that portion of competitive lease application C-22677 that lies south of Energy 2 it would directly displace sharptail grouse from their dancing grounds.

Off-site impacts to the Green Acres big game hunting would remain unmitigated. As discussed in Chapter III, these might be either adverse or beneficial impacts, or a combination of both. The values of impacts upon Green Acres would depend upon the resulting increase or decrease in hunting potential; only Green Acres users would be either beneficially or adversely affected.

Relative values of these unavoidable adverse impacts would be determined by the availability of other similar recreation opportunities in the region. The sharptail dancing ground presently provides no public viewing opportunities, though several do occur in the region (See Terrestrial Fauna, Chapter II, Regional Analysis).

Destruction of unknown cultural resources could not be totally avoided by conducting reconaissance surveys, because significant resources might lie hidden below the surface. Impacts to unknown cultural (archaeologic and historic) resources have commensurate unknown values. As no public surface is involved, only the private landowner would be immediately affected. The nature of the unknown cultural resource would determine whether significent public values are also present.

Transportation Networks

Highways

Increased railroad traffic should mean that crossing problems for local residents would be increased both in the area of the Energy spur and along the D&RGW branch line south of Milner. If these problems are not alleviated by upgrading of the two unimproved crossings, the numbers of railroad-automobile accidents would increase to some extent.

Railroads

D&RGW has stated that their diesel engines are equipped with the latest pollution control devices; however some decrease in air quality along the transportation corridor would be unavoidable; the increase would not be significant.

Chapter VI

Relationship Between Short-Term Uses and Long-Term Productivity of the Environment

THIS CHAPTER DISCUSSES THE EXTENT OF LONG-TERM IMPAIRMENT OR ENHANCEMENT OF RESOURCE VALUES THAT WOULD OCCUR, GIVEN THE SHORT-TERM USES OF THE ENVIRONMENT PROPOSED IN ENERGY FUELS CORPORATION'S MINE AND RECLAMATION PLAN. IN THIS ANALYSIS OF TRADE-OFFS OVER TIME AND TRADE-OFFS AMONG RESOURCE VALUES, SHORT-TERM REFERS TO THAT PERIOD WHEN SUBSTANTIVE PARTS OF ENERGY FUELS CORPORATION'S PROPOSED ACTION TAKE PLACE. LONG-TERM IS THAT PERIOD IN WHICH SUBSEQUENT IMPACTS, BOTH ADVERSE AND BENEFICIAL, STILL AFFECT THE ENVIRONMENT.

CHAPTER VI

RELATIONSHIP BETWEEN SHORT TERM USES AND LONG TERM PRODUCTIVITY OF THE ENVIRONMENT

Paleontology

Unavoidable paleontological impacts would be experienced in the short-term during the mine's operation. After completion of the mining operation, no further impacts would occur.

Options for future use of these subsurface resources would be foreclosed by their destruction. However, the operation itself could disclose knowledge of fossils heretofore unknown; this would create options for future generations to benefit from the newly-found resources.

Mineral Resources

Short-term use of Energy Fuels' coal resources will be relatively rapid mining, using large equipment in methods currently used, particularly draglines. Although allowing for more rapid and possibly more economical recovery, these methods are commonly considered to result in the loss of about ten percent of the mined bed(s). They also result in the loss of nearby overlying and underlying beds of coal, which are considered by the operators to be too thin to recover economically, but which could perhaps be recovered by slower, more costly methods.

Beds of minable coal lie below the mined (Wadge, Fish Creek) bed at depths which call for underground mining (or in-situ gasification, etc.), but these methods cannot be safely used until the strip mining with its attendant necessary blasting would be completed. Thus the large-scale rapid mining methods used here would allow an earlier start in the development of the deeper coal beds, than slower, more coal-conserving methods.

Water Resources

Ground Water

Changes in the ground water systems would have no measurable effect on the long term productivity of the environment.

Surface Water - Aquatic Biology

Aquatic environment would be disturbed by proposed mining activity. Water quality would be degraded through an increase in sediment loading and total dissolved solids throughout the life of the project. Aquatic organisms would be displaced for as long as the mining activity continues, and some organisms would be harmed or killed during the initial adjustment period. Some small intermittent drainages would be destroyed as a result of the proposed mining activity, resulting in alterations to local runoff patterns. In addition some aquatic habitat would be lost because of mining development in the area, such as road construction across local perennial streams.

Long-term productivity of the aquatic environment could be expanded by the development of pond or reservoir fisheries habitat in conjunction with the proposed mining activity. For instance, water which would accumulate in the mine pits could be purified and stocked with fish species suited to the specific quality of the pit water.

Air Quality

Assuming that the land surface would be reclaimed and returned to an equivalent of the pre-existing vegetative cover and general contours, the air pollution resulting from the mine would be a short-term phenomena;

that is, it would occur only during active mining. Air pollution from vehicle exhausts and fugitive dust after mining is complete would also depend on the subsequent use of the land. Access to the properties involved will have been established. Lack of complete reclamation, specifically vegetative cover and erosion protection, could cause blowing dust to be a continual problem.

Soils

Mining by Energy Fuels will result in the introduction of new roads, buildings, powerlines, and heavy equipment into an area not appreciably changed from its natural state, except for some transportation routes and structures associated with grazing and farming activities.

The lease areas will be committed to coal production for a period of about 15 years based on anticipated production levels.

Impacts arising from the short-term use of the environment would be minimized to the greatest extent practicable, with modern mining and reclamation practices. Grading of spoils would reduce ridges to a topography aesthetically consistent with surrounding undisturbed areas.

The preceding plan indicates that short-term use of parts of the leasehold for mining would be accompanied and followed by a period of reclamation.

At maximum production, about 350 acres would be disturbed by mining each year, with an equal number of acres undergoing grading and planting. At any one time the total area out of production will be about 1400 acres. The principal long-term changes will be local modification of the topography and surface drainage systems, soil loss, and reduction of productive capacity.

Terrestrial Flora

The short term uses would be the total destruction of vegetation by the mining operation, roads, facilities, and areas needed for the population increase. Approximately 350 acres would be totally disturbed at any given time before reclamation begins. Areas to be returned to grazing land would require three years for vegetation establishment; however areas returned to cropland should be usable the first year after shaping and topsoil replacement, if a fertilizer program is utilized. Areas used for roads and facilities, and areas for the population would be permanently lost, and will involve approximately 350 acres.

If fertilizer is used, the long term productivity of areas returned to cropland should approximately equal the production before mining, and a ten percent loss in production has been projected for areas returned to grazing land. The return of mined areas to productivity would depend upon the diligence of Energy Fuels Company in implementing their reclamation program.

Terrestrial Fauna

Wild Fauna

Short-term use of the subject area would entail the complete destruction of that portion of the ecosystem where mining is to take place, as well as any areas where roads are constructed. In addition to these totally impacted areas, wildlife inhabiting adjacent lands would receive some degree of a lesser impact from dust, noise, and human or vehicular activity. Some areas adjacent to the lease area have already been mined. Therefore the short term effect would not be as severe as it would be if this were an undisturbed habitat.

Short-term use of Energy Fuels lease area by all species of wildlife would be lessened; the degree of reduced use would depend on the ability of the species involved to adapt.

Long-term productivity is expected to be reduced because loss of soil productivity and disruption of cover would reduce the area's ability to attract and sustain wildlife. The degree and direction of wildlife replacement would depend on the reclamation program's success. Plans for revegetating the area indicate that present species composition and densities would never return. Long-term production of those species associated with grasslands would increase within the lease; those species associated with sagebrush, shrubs, and trees would decline (See Appendix D).

Domestic Fauna

Short-term use of the lease area would be completely restricted for livestock; the lease area would be fenced to exclude use by domestic fauna.

Long-term productivity would be increased because of revegetation plans. Present proposals are to turn approximately 41 percent of the mined areas into grasslands, primarily for livestock grazing.

Archeological Resources

Archeological values, if present, would be impacted during the short-run by actual surface disturbance. Potential for vandalism would be experienced largely in the short-term.

Options for future use of cultural resources would be foreclosed by the degree of unavoidable impact from the mining operation. However required intensive cultural surveys could reveal presently hidden values; this would create options for future generations to benefit from the newly-found resources.

Historical Resources

Unavoidable impacts upon historical resources would occur only in the short-term. Once mining operations cease, the potential for vandalism and destruction of the old buildings and structures would return to its present state.

Aesthetics

The short-term encompasses the time-frame of the proposed action, up to 1990. Given the mitigating measures discussed in Chapter IV short-term impacts would be significantly reduced. After 1990 long-term unavoidable impacts on the area's aesthetics would still remain, though they would be less significant than short-term impacts. However, long-term impacts would be partially mitigated with the passage of time. Examples of long-term mitigations include the gradual weathering of cuts and fills and the ecological succession that establishes plant communities.

Recreation

The short-term encompasses the time-frame of the proposed action, up to 1990. Short-term use of the area would result in several beneficial impacts to recreation resources. After 1990 much of this recreational productivity would remain. Increased off-road vehicle use and potential and additional wildlife viewing opportunities would improve recreation capabilities on a long-term basis. However success in reclamation and the ultimate cessation of mining operations would decrease rockhounding and geologic-industrial interpretive capabilities, although new mining operations in adjacent areas might be linked with successful reclamation efforts in the proposed action areas to create long-term interpretive capabilities for recreation use.

Chapter VII

Irreversible and Irretrievable Commitments of Resources

THIS CHAPTER QUANTIFIES THOSE RESOURCES THAT WOULD BE CONSUMED AND PERMANENTLY LOST AS A RESULT OF THE IMPLEMENTATION OF ENERGY FUELS CORPORATION'S PROPOSED ACTION. SUCH LOSSES ARE IRRETRIEVABLE COMMITMENTS; I.E., ONCE THESE RESOURCES ARE USED, THEY CANNOT BE REPLACED.

THIS CHAPTER ALSO OUTLINES THOSE USES OF ENVIRONMENTAL COMPONENTS THAT COULD NOT BE REVERSED SHOULD THE PROPOSED ACTION BE IMPLEMENTED. ONCE INITIATED, THESE USES WOULD CONTINUE INDEFINITELY.

CHAPTER VII

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Paleontology

Approval of the Energy Fuels mine plan would be an irreversible commitment of fossils. Those fossils unavoidably impacted would be irretrievably lost upon completion of the mining operation.

Mineral Resources

The major irreversible and irretrievable commitment of mineral resources by the present and proposed mining activities is the production of coal for consumption, including loss in mining, of about 77 million tons of coal in the 15-year period of 1975-1990.

This commitment is distributed as follows, by millions of short tons:

TABLE EVII-1

Commitment of Coal by the Energy Fuels Corporation

Year	Produced	Loss in Mining	Total
1975	3.0	0.30	3.30
1976	3.5	0.40	3.85
1977	4.0	0.40	4.40
1978	4.5	0.50	4.95
1979	5.0	0.60	5.60
1980-1990	50.0	5.50	55.50
	70.0	7.7	77.60

An undeterminable amount of sand, gravel, and clinker will be required for mine roads and other support facilities.

Water Resources

Some surface water would be irretrievably committed to the proposed mining activity, as a result of increased domestic consumption at the mine site, in surrounding towns, and from the mining activity itself (i.e., utilization of ground water for dust control). In addition aquatic habitat would be permanently removed from production as a result of haul road bridge construction and other mining-related encroachments into the stream bed. Also natural drainage patterns would be permanently altered in some locations as a result of the proposed strip mine activity. There are no significant irreversible or irretrievable commitments of ground water resources.

Air Quality

Local, very small changes in climate or the atmospheric resources would result from the redistribution of the surface material at the mine. Changes in contours and surface characteristics would irreversibly alter the wind field and surface heating of the air. The air quality degradation would be reversible if reclamation is complete.

Terrestrial Flora, Fauna and Soils

It is difficult to predict reclamation success of Energy Fuel's mined lands. Return to a self-sustaining ecosystem should be possible, considering existing climatic conditions, and Energy Fuel's plan to replace topsoil and transplant some native shrubs and trees, but productivity is projected to be ten percent less. However, existing soil profiles and vegetative ecosystems would be irretrievably lost.

Wildlife resources that might be irretrievably lost include individual animals and habitats that are destroyed. Animals and plants that would have reproduced in the affected habitats during the life of the mine might also be irretrievably lost. Most wildlife losses might be reversible if the species and habitat are not impacted to the point that their ability to reproduce is seriously impaired.

The annual forage production which the area could have produced will be lost during the time that mining and reclamation takes place. Production will be lost on approximately 1400 acres annually, i.e., 220 livestock AUMs per year; this lost production increment is an irreversible commitment of forage for livestock and wildlife. Approximately 350 acres will be permanently disturbed, and vegetative production will be irretrievably lost. Fertilizer utilized in the reclamation program will also be irretrievably lost.

Archeological Resources

Unavoidable impacts to cultural resources would constitute an irreversible commitment of these resources when the mine plan would be approved. Upon completion of the mining operation, unavoidable impacts would be irretrievably committed, in terms of adverse impacts that cannot be avoided.

Historical Resources

Irreversible and irretrievable commitments of historical resources would occur as described in the section on archeological resources.

Aesthetics

Commitment of the proposed action areas to coal development would be an irreversible commitment of aesthetic resources related to both unavoidable and long-term minus deviations. These residual impacts would be for all practical purposes irreversible.

Recreation

Commitment of the proposed action areas to coal development would result in irreversible commitments of recreational resources, though they would be largely beneficial. However, destruction of sharptail grouse dancing grounds and of unknown cultural resources would be, for all practical purposes, irreversible.

Chapter VIII

Alternatives to the Proposed Action

INCLUDED IN THIS CHAPTER IS A DISCUSSION OF ALL REASONABLE ALTERNATIVES TO ENERGY FUELS CORPORATION'S MINE PROPOSAL. THE IMPACTS RESULTING FROM THESE ALTERNATIVES ARE ALSO ANALYZED IN THIS CHAPTER.

CHAPTER VIII

ALTERNATIVES TO THE PROPOSED ACTION

Reject Mining Plan

Because Energy Fuels has recently obtained approval of their 5-year mining plan on three currently held Federal coal leases, rejection of this plan is not possible. Possible alternatives for the 5-year plan open to the Federal government at this time are: (1) inclusion of additional stipulations to further protect the environment (identified in Chapter IV of this analysis), and (2) action on competitive lease applications C-20900 and C-16284 which were included in Energy Fuels 5-year plan, but for which approval has not been granted.

Should the Federal government decide not to put the two lease applications up for competitive bid, Energy Fuels could continue mining operations on its Federal acreage covered by the existing mine plan, and on privately owned coal in the area, with the same primary and secondary impacts as those evolving from mining the lease application areas, together with the additional Federal and private coal. The company's private coal reserves and Federal coal under the approved plan could sustain production at proposed levels for only five or six years. Should these lands not be put up for auction, no environmental impact would occur, and they would continue in their present condition or be modified by the surface owner to meet other uses. Because these lease application areas contain only a small quantity of coal it is doubtful that another operator would find these isolated blocks economically attractive to mine at a later date. A decision to refrain from offering these applications competitively in the near future may therefore preclude their being mined.

The Federal government also has the option of whether or not to place the four additional competitive lease application areas (C-22644, C-9968, C-22676 and C-22677) requested by Energy Fuels up for bid. A decision to refrain from offering these application areas competitively may force Energy Fuels to move to another area in five to six years, following extraction of its currently held coal. Another option open to Energy Fuels would be to close the company's three mines. This would result in the loss of jobs for 175 people currently employed by the coal company; these employees might eventually obtain other jobs in the area, but many undoubtedly would be forced to seek employment outside the area or remain unemployed. The number of people directly affected by the loss of jobs is significant when the small population of the county and the low level of industrial activity are considered.

Public Service Company of Colorado would also be affected by a shutdown of the mines, as half of that utility's coal supply for power generation is obtained from Energy Fuels Corporation. Power cutbacks or shortages could occur in eastern Colorado until another source of coal was found. Electric rates could conceivably increase if the purchase price of the coal from other sources was greater than that from Energy Fuels.

If the mine closed, county and State facilities might be adversely impacted by decreased income from taxes and production royalties. Colorado has a personal income tax, a corporate income tax, and a general property tax levied by the county on mine equipment, and receives 37 1/2 percent of all production royalties from the Federal leases. Local tax revenues would be decreased as a result of a mine shutdown. Unless tax rates increased, the quality of present services would decline.

Require Modification of Mining

Some of the impacts identified and discussed under the heading "Adverse Impacts" which cannot be avoided if the proposal is implemented, could be avoided, if the mining plan was modified to require the use of one or more of the operational alternatives discussed hereafter. In addition, special conditions could be added to the plan to mitigate some secondary effects of the mining. Such conditions must be reasonable, and if economically unacceptable to the company, could result in the company not developing the area, with the resultant impacts discussed under the heading "Reject Mining Plans".

Different Mining Methods

Underground mining

Substitution of this method of mining would result in less initial disturbance of the land surface; however unsupported mine roofs between pillars could ultimately collapse because of lack of structural strength in the thin overburden. This would result in a partly subsided land surface degraded by numerous depressions and openings. Substitution of underground mining would also result in: (1) greater costs because underground mining is more costly than surface mining, (2) a decrease in mine safety as indicated by the fatal accident rates in 1972 of 0.42/million tons mined underground, compared to 0.07/million tons for surface mining, (3) higher incidence of non-fatal accidents due to roof and coal falls, fires, explosions, and problems related to dust inhalation (black lung disease), and (4) less coal recovery.

On Energy Fuels Federal leaseholds, much of the Fish Creek Seam would be nearly impossible to mine by underground methods because of thin overburden; the overburden depth over much of the Energy 2 area never exceeds 20 feet; this would not be enough to support the roof in an underground operation.

Some of the acreage where mining is planned for Wadge seam coal would also be impossible to mine because of shallow overburden. However the Wadge seam is generally overlain with a fairly competent roof, and where overburden depths exceed approximately 40 feet, the coal could be extracted by underground methods. Assuming the entire 6-12 foot section of the seam could be mined safely by underground methods, and that 50 percent of coal in the mined area was left in place to provide support and lessen the probability of surface subsidence, coal extracted would represent about 45 percent of available coal in place. This rate compares to the present recovery of approximately 90-95 percent of available coal by strip methods. An underground operation could still be conducted on coal reserves which lie below current economic overburden depth of stripping equipment, following extraction of the strip mined coal.

In-situ production

In-situ burning of coal is at present an experimental process involving the fracturing and igniting of coal underground, to produce clean burning gas that is collected from boreholes drilled into the coal seams. Present knowledge indicates that energy recovery levels of in-situ production are low, and the amount of surface subsidence in areas of thin overburden is highly unpredictable. Impacts associated with in-situ production would include the possibility of destruction of a coalbed aquifer, pollution of ground water, and air pollution from escaping gases. There would be disturbance of the surface due to the construction of facilities built to process the gas produced.

For in-situ production to be a viable alternative technique, methods for increased recovery of volatile gases must be developed. Such increases could then allow in-situ production to compare favorably with the high recovery of coal by surface mining methods.

Auger mining

Auger mining should probably not be considered as a realistic or viable alternative to surface mining because it is only used under specific conditions. Auger mining is used to recover coal along a highwall of an existing surface mine which has reached its maximum overburden limits; effective penetration depth is limited to approximately 200-300 feet. In beds thinner than seven feet, recovery is less than 40 percent of the coal penetrated, and would be somewhat less for the 10 foot thick Wadge seam. Auger mining is not applicable on Energy Fuels leaseholds to supply the quantities of coal required.

Different Production Rate

Energy Fuels is currently contracted to supply 3.3 million tons of coal/year to its various customers. The proposed mine expansion program would increase the rate to five million tons/year by 1977.

Any change in production rate either up or down would alter the rate or intensity of the environmental impacts discussed previously in this statement. If a reduction in proposed production rate were required, it would create a shortage of fuel at the power plants in the area of consumption, resulting in decreased power production when consumption is increasing unless substitute sources of supply were obtained. A reduction would also prolong mining activity on the leasehold, prolong the time until restoration is completed, lessen employment at the mine, lessen disturbed acreage at any one time, and lessen annual tax and royalty returns to the State and county from the Federal leases.

If the company was required to increase production above the level proposed, it would increase the intensity and severity of the impacts described elsewhere in Chapter III, decrease the length of time for mining and reclamation, and increase annual tax and royalty returns.

Different Reclamation Objectives

Alternate land uses for the disturbed areas are discussed in Chapter IX of the Regional Analysis. All reclamation objectives listed could apply to various parts of Energy Fuels mined lands, grazing land for domestic livestock, wildlife habitat, recreation, urban and commercial development, and multiple use.

Transportation

Different Transportation of Coal

Truck transport

Since a rail spur to the D&RGW line already exists from the Energy Fuels mining sites with adequate loading facilities for the anticipated increased output, building a new roadway to the sites or modifying existing county roads for coal transport would impose unnecessary environmental impacts in construction, modification, and use of such roadways. As has been stated in the Regional Analysis, heavy use of the existing roadways in this area by coal trucks would cause drastic degradation of these roadways.

Slurry pipeline

A coal slurry pipeline would be capable of transporting the coal production from the Energy Fuels mines in northwestern Colorado to the terminus at steel mills in Pueblo. As described in Chapter IX of the Regional Analysis, such a pipeline could easily handle the entire volume of 4.5 million tons intended for this market. The large volumes of water necessary to transport the coal in slurry form might be used in the steel mills in Pueblo, thus mitigating some of the water disposal problem.

However this would be a long pipeline requiring pumping stations along the way, as well as preparation plants at either end. The existence and use of such a pipeline has less impacts on air quality than a rail line, but would add on impacts such as a large, consumptive water requirement. When one considers the fact that a rail spur connecting to the D&RGW branch line already exists with adequate transport capacity for the increased production of the Energy Fuels mines, the extra environmental impacts of the construction and use of such a pipeline are considered unacceptable.

Conveyor belts

Belt conveyors can be used as an alternative to rail transport of coal. Expertise is sufficiently advanced to assure technically sound construction of single or multiple flight conveyors for coal transport.

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Long distance belt conveyors have never been built, however. A 12 mile long belt could be considered long distance and would probably require extensive design work.

Since the impacts of construction of a conveyor belt system would be added to an environment with an existing rail line adequate for the needed coal transport, the impacts associated with building and operating such a system (though the system may be practical) are considered unacceptable.

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